AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 3, No. 20. WEEKLY. | NEW YORK, MAY 15, 1880. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * I wish some one would invent some way of fastening cylinder heads on, which would be as simple and nice and easy and cheap as sticking a postage stamp on a letter. There are half a dozen plans, all of which seem to possess virtues and vices in equal proportion.

* * * * The good old way was to put a bolt through the cylinder flange and head, and put a nut on the outside. There was no discount on this arrangement; the thing was strong and solid and cheap. If a bolt broke, a new one could be easily put in, without taking a cylinder head off, and it could be done by any blacksmith. There was no tapping of cylinder flanges required, and no fussing with broken studs. This plan is still in vogue on river and ocean work, but seldom or never seen on stationary or railroad work. The faults of the plan are these: A large cylinder flange is required, which makes the job heavy, expensive and somewhat unsightly. If the cylinder was lagged, and proper precautions not taken, some bolt would get pushed back and fall into the lag chamber. Then the lagging has to be ripped off to get the bolt out. It's much like the story of the cat. The cat got its head fast in the cream pitcher; they had to cut the cat's head off to save the cream pitcher, and then they had to break the cream pitcher to get the head out.

The inside face of a cylinder flange being rough and inaccessible, no nice uniform length can be found for such bolts. They must be put in place and ended off to match the nuts nicely, and then each bolt must be marked to its proper place. Any kind of work which requires that bolts apparently alike should be put back in exactly the same holes they came out of, is bad work. It shows that the work has been made by the cut-and-try rule.

Last, but not least, these bolts are as ugly as sin. On common stationary engine work, where no jacketing is used, the awkward appearance of these inside bolt-heads would overbalance any special virtues an engine might have, and it would be very difficult to convince the average purchaser that the engine was a good engine. One of the real vices of the bolt plan should not be forgotten. These bolts will sag down, or sag up, or sag most any way but the way which will allow a cylinder head to be put on over them. It is exasperating to see three or four men putting one little cylinder head on, and it's the best kind of fun to see one man try to do it alone, if through end bolts are used.

* * * * Now we come to a stud screwed tightly into the flange of the cylinder, with a nut outside of the head. I was brought up on these studs, and have always used them; but if they have any merit as cylinder head fastenings for stationary engine work I have never been able to detect it.

In the first place, no amount of supervision or system will insure that the studs fit right in the flange. It's a case of pure faith in the apprentice who makes the studs. If a tip top journeyman does the work it is not better. A man who has no pride which will keep him off of such work hasn't got pride enough to care whether the studs fit or not. The intention is to have these studs fit good and solid the whole depth. The lathesman starts out with this intention, but the thing will end in good intentions.

If you take the ones which seem to fit, you will find that all the tightness was on the inevitable thick thread on the end. Chamfer this thick thread off of these nicely fitting studs and you will find them somewhat shaky.

But all of these studs ain't nicely fitted in any respect. The ambitious lathesman who is satisfied to do screw-machine work on a lathe is satisfied if he gets six good fits out of ten trials.

There don't seem to be any way to fit such work, if it is done in a common lathe, except by trial. If a trial shows that the job has been cut too deep, there is a way of getting around it. Two ways in fact. One is to mash the thread up with a hammer, and then screw her in, and the other is to screw it in for keeps against the shoulder or last thread. One turn of such a stud and it will almost fall out.

Next comes the difficulty of getting nuts to flush, and finish nicely with the end of the stud. If the stud has a shoulder or collar it's easy to do this. The draughtsman, if there is such a man around, simply figures the thing and says—one and seven-eighths. The lathesman works to the figure, and nice work results. But if there is no shoulder for the tight fit to screw against, it is hard to get a nice flush job. Some lathesmen put the work all together, put the nuts on and mark each stud with a chisel just at the surface of the nut. Then he takes all these elegant studs out, and he's always afraid somebody will watch him as he is doing it. When he gets the studs rounded up and back in their place, every thing will look o.k., but in all this fussing he has jammed up the ground joint. Now the fitter swears a little, and has to take all the studs out so he can grind the joint again, and he detects the snide fits the lathesman has made, and then there's a row, or a confederation. When the fitter puts the job together again, he finds that studs of this kind won't be the right length unless they are put in the right holes. He has only two of them placed right and he spends two hours transposing them. It is a good fit indeed which will stand this screwing and unscrewing without getting loose. The cast iron thread don't wear, the thread of the stud just gets into good shape, and gets to be an ordinary fit.

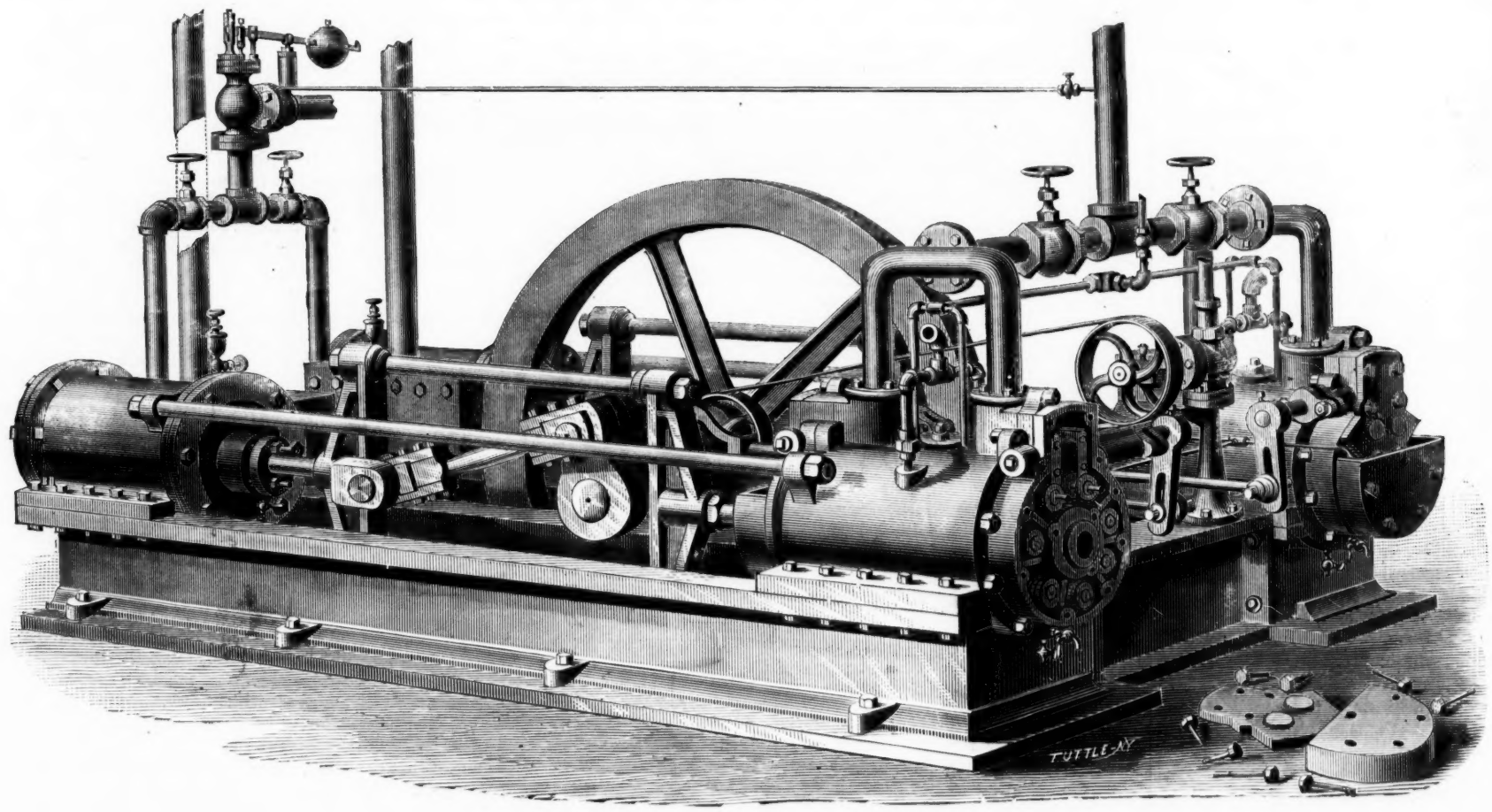
The first time an engineer takes a cylinder head 'off, half the studs come out with the nuts. One quarter unscrew, the other quarter twist off. Then comes the job of getting an old stud out, by chisel or drill.

* * * * There are two mean jobs in the shop whose memory will always haunt me. One is to fool with an old stud which has got twisted off, and the other is to cut gas pipe in a lathe.

* * * * Locomotive men save the fine work on these studs by making them as rough as the law allows. They then cover up the horrible thing with a gorgeous brass mask all fair without and foul within.

* * * * Some engine builders have hit on the happy idea of a cap nut. With such nuts the length of the stud is not a fine matter. Some folks even cut these studs in a bolt cutter in bars, and then cut them up in lengths in the lathe. The die is made to cut a tight fit, and the nuts are tapped slightly larger.

With all of a machinist's respect for screws cut in the lathe, and with all of the usual contempt for work done in a bolt cutter, I believe the worst of these bolt-cutter jobs to be better than the best lathe work I have seen. I have cut lots of engine studs in a



A New Style of Air Compressor.—See Page 2.

lathe, and they were just like the average—that is very bad. I never liked to be around when any decent mechanic got to unscrewing them.

* * * * I believe the cap nuts are a nice thing. Those that I have seen were of malleable iron, with a chamber cast in them so as to tap free. They are tapped and faced at one chucking, and then finished on the face on a nose mandrel. They are awkward in shape, being almost always of an O G form which never matches anything else on any machine I have ever seen them on. I believe if some of the nut companies would go to work and put into the market nicely furnished hexagon nuts, with the hole tapped of a depth, say, an eighth of an inch more than the diameter, that the aforesaid nuts would find a decent sale. They would look like a bolt head a quarter of an inch longer than usual.

The slightly increased cost of such nuts would be more than compensated for in the saving of work, in flushing and otherwise fooling with the length of studs. Such nuts would be used on cylinder head-work, on steam chests, and generally throughout engine work. They wipe up nice, and clean and protect the end of the stud from accidental burring or riveting.

* * * * The English have a tool—I think its English—which is intended to trim up the ends of studs after they are screwed in place. The tool is a ratchet affair, of simple construction, and makes uniform and nice work.

* * * * I will lose my hard-earned reputation by saying it, but my kind of a stud for cylinder heads is a common tap bolt. I have had all the experience I want with studs, and have seen enough of tap bolts to like them.

The first thought is that this plan of screwing a bolt into cast-iron is not right. It is supposed to wear out. I have never heard of any wearing out, but I have noticed that the screw itself will wear away more rapidly when screwed into a cast iron hole than when in a wrought iron one. I suppose that is because the tap dust never gets out of the hole. I believe in using good sharp taps and plenty of them, and cutting a good deep thread in cast iron *dry*. After the tapping is done and the hole blown clean is soon enough to put oil in.

* * * * Cylinder head-screws don't have to stand the racket they used to. In olden times, when hemp packing was used in pistons, the cylinder heads had to come off once a week. Now we use packing, which if let alone will tend to itself for a year. A good and proper piston in a stationary engine will last six or eight years if it ain't fooled with. As far as the piston is concerned everything would be in its favor if the cylinder head was brazed on solid, so officious engineers couldn't get inside the cylinder. Some engineers look to the piston packing trouble. If the crank pin heats, set the packing in, if the cold water pump won't work set the engine packing out.

Modern piston packing is best when let alone and modern cylinders don't need opening much. The careful engineer loosens up every bolt once in a while and oils them up to guard against corrosion, and in modern engines with metallic piston packing and ground cylinder head joints the tapped bolt screwed right into the cast iron is a good job. Such bolts or screws can be machine made, uniform, nice and cheap, and good. Some of the best engine builders in the world are adopting the plan for cylinder heads, bonnet work, &c.

When you take out such screws you have a clean face, and can give a ground joint a rub in oil before closing up.

* * * * Very respectfully,

CHORDAL.

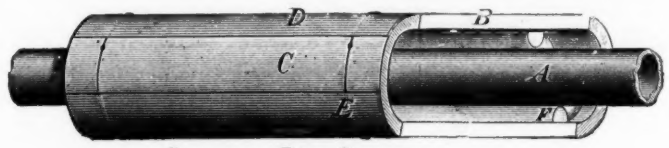
Wages per week at Lock Haven, Pa., are reported as follows: Moulders, $10.50; foundry laborers, $6; machinists, $10.50; machinists' helpers, $6; blacksmiths, $15; blacksmiths' helpers', $6; casting cleaners, $6; wood workers, $12; pattern makers, $15; painters, $12; boiler makers, $12; holders-on, $7.50; teamsters, $6; tinsmiths, $15; yard laborers, $6.

New Style of Air Compressor.

In the AMERICAN MACHINIST of Dec. 20, 1879, we illustrated the Duplex Air Compressor, built at the Clayton Steam Pump and Compressor Works, 14 and 16 Water St., Brooklyn, N. Y. The compressor there shown was of the yoke pattern. We now illustrate on our first page one embracing the same general features, excepting that the yokes are rigidly connected top and bottom and placed sufficiently far apart to admit of a connecting rod being substituted for the "sliding journal boxes," which we then described. The weight of the yokes, connecting rod, and other reciprocating parts, are carried on a long "slipper guide," not shown in the cut, and by this means the piston rods are relieved from any undue weight of such parts. Having so recently called attention to the prominent features of this compressor, we shall, at this time, but briefly recapitulate what we there said.

First. Special advantages are claimed for the arrangement of the water jacket, whereby the coldest water is first brought in contact with a portion of the top of the air cylinder and the ends, which parts of the cylinder are alternately subjected to the highest temperature, resultant from the compression of the air.

Second. The air valves (both induction and eduction) are placed in the heads. The



SECTIONAL PIPE COVERING.

FIG. 1.

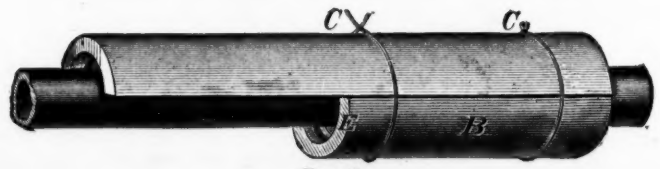


FIG. 2.

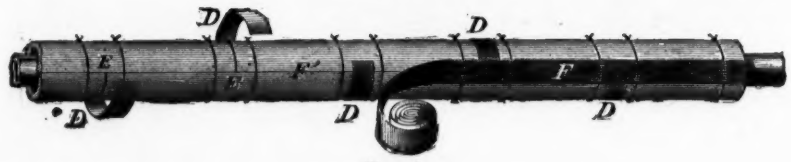


FIG. 2.

seats are screwed into the cylinder covers, and admit of easy removal. A semi-elastic disc is attached to the face of each valve, which reduces the wear and materially lessens the concussive shock which such valves sustain when they seat "metal to metal." Besides the usual valve stem, each valve which opens into the cylinder is supplied with "safety stems," which prevent the valve from dropping into the cylinder and causing great damage in case of the breakage of the main "stem."

Third. A "tripping device" is employed to lift the delivery valves from their seats at any desired point of the stroke, the rocker arm, which works the "trip," is slotted to admit of adjusting the point at which the valve is lifted, and the compressed air in the cylinder allowed to escape into the receiver or pipes.

Fourth. A rotary lubricating valve is employed to supply a fixed quantity of water, air, or other suitable fluid, to the air cylinder at each half stroke. When the compressor is at rest, the supply is cut off, and no danger of flooding the cylinder is incurred.

Fifth. The automatic air governor controls the working of the compressor with such nicety, that within the limit of its capacity to supply the air, the pressure in the receiver remains uniform, irrespective of the quantity withdrawn from it. Having illustrated and described a number of air compressors at different times, which were made by different manufacturers, our readers are doubtless interested to know something more of the comparative efficiency of, and degree of perfection attained, in the compression of air. Of this subject we expect to say more in a future issue.

Balky Locomotives.

Locomotives are strange animals. Some doubtless remark: "That is a queer expression. I do not see any similarity between a locomotive and an animal." Locomotives behave very curiously sometimes, as, for instance, when some careless boiler maker on inspecting or repairing the tank upsets his lamp, and leaves it inside, or allows the oil to run out. When the engine goes out on the road the oil is pumped into the boiler and causes it to foam. Sometimes an engineer wishing to play a joke upon a certain comrade will put a little soap or oil in the tank, or slip a few pieces of bar soap into the feed pipe, and play many other tricks too numerous and too mischievous to mention. When an engine begins foaming on the road, some engineers will fill up the boiler, then pull the throttle wide open and throw out the dirt through the engine, and work it out in that way. This process makes sad havoc with the brass work and paint upon which the fireman has spent so much time in cleaning it. This process is also the cause of more or less profanity, the force and extent of which depends upon the nature of the parties concerned. The engineer upon whom these jokes have been inflicted may be entirely ignorant of the cause of all his trouble, and when interviewed as to the facts concerning the case will relate his experience in something like the following style, which we clip from the *Daily Graphic*:

"He's been in the dumps because the locomotive has been 'off' for three or four days," said a railroad man to a companion the other day, as he pointed to an engineer.

"How off?"

"Go and ask him."

It took a quarter of an hour and a cigar to clear the cloud from the engineer's face, and then in reply to the query he said:

"It is a queer thing. There's my engine, one of the best on the road, in perfect order, only 12 years old, and able to run or pull with the best of them. A month ago I hadn't the least bit of trouble in making time, no matter how the track was or the weight of the train. She was ready at the word, held her steam beautifully, and she seemed to understand every word I said. To-day she is down in the round-house, growling and spluttering, and acting as if she wanted to pick a fuss with a gravel-pit."

"Anything out of gear?"

"Not a thing. She's been looked over twice, and we can't find the least excuse for her conduct. She'll get over it in a day or two, perhaps. If she don't we'll punish her."

"How?"

"Put her before a freight or stock train. I've seen it tried a dozen times and it most always worked well. Here she is now, bright as a new dollar and as handsome as a picture, and I'll bet $50 that there isn't the least thing out of order. She's simply sulking, the same as a child or a woman, and I know what started it. Three weeks ago, while on my run in with the night express, she just wanted to light out for all she was worth. She took the bit like a running horse, and if I hadn't choked her off she'd have beaten schedule time by 20 minutes. She acted mad right away, and in running 20 miles she gave me more trouble than I ever had with her in a run of 300. She lost steam, tried to foam over, choked her pipes, and when I wanted more steam she'd slide on her drivers. She went right back on me that night and has been sulking ever since."

"Do all engines do this?"

"Not all, but many of them. Some folks laugh at us and call it superstition, but they never lived in an engine cab."

The Standard Sectional Covering.

The illustrations herewith represent what is described as the Standard Sectional Covering, made by Samuel Raymond & Co. (factory, 642 West Fifty-second Street, and office, 108 Liberty Street, New York), for use upon steam, hot blast, hot air and water pipes, steam drums, cylinders, boilers, and all receptacles for super-heated steam.

By the use of this covering live steam can be delivered at any distance from the boiler at nearly the same pressure as indicated at the boiler.

The covering consists of a cylinder of any required size, composed of non-conducting materials. This is made in sections divided longitudinally, and of the uniform length of 24 inches, and is so constructed as to provide a continuous dead-air space between the pipe or boiler and the covering itself. This cylinder is placed around the pipe to be protected, and covered with paper so as to break all the joints. It is then coated with a liquid which resolves itself into a hard surface, as impervious to water as stone, making the covering air-tight and also fire-proof.

It is claimed for this covering:

1st. It is made in sections of a convenient and uniform length, and is easily put on by any one.

2d. It is easily removed from any portion of the pipe, so that repairs or alterations can be made without destroying the covering, and in most cases the same covering can be replaced, and will look as well as when first applied.

3d. It is applied dry. Pipes therefore cannot be injured by rust.

4th. It is cleanly,—does not crumble and fall off.

5th. It can be applied to hot pipes; there is therefore no necessity for stopping work.

Fig. 1 shows a section of pipe, covering two feet long; Fig. 2 represents pipe with covering wired on, before paper is applied. The air space between the steam pipe and covering should be stopped with a composition tempered with water, and applied with a trowel at both ends of pipe, care being taken to force the filling well under the covering.

Fig. 3 shows manner of applying the paper, each strip being lapped on the preceding about two inches. Full directions for applying will be furnished by the makers on application.

Mechanical Confusion.

BY CHAS. A. HAGUE.

Observation gives rise to reflection; reflection generally seeks expression: hence, the following remarks concerning mechanical confusion; not only that which is embodied in the ideas verbally expressed by men, but also the gleanings from well recognized works on mechanical application.

Select any branch we may please of the different subjects; divide it under numerous general heads, and then, beginning to work up the details, we perceive the immensity of the undertaking, the almost endless variety of conditions under which any apparently simple operation may be performed. The number of different combinations into which any certain group of elements may be formed, is as numerous as the different values of the figures which express them.

One of the most confused and indefinite branches of applied mechanics, is that which relates to the transmission of power by means of pulleys and belting. We find formulæ at every hand for computing the

necessary proportions of pulleys and belts, but in some of the data the most important factors are omitted altogether. The writer has questioned and cross-examined numerous belt manufacturers as to whether they would guarantee that their belts would drive a certain load. Of course they would, and give it in the form of a contract, too. But upon being interrogated as to their method of computing the power to be transmitted by any certain sized belt, we obtain as many indefinite answers as there are belt men, and when it actually comes to writing and signing a contract that means anything, about nine out of ten lack confidence in their own productions. Belting, in a majority of cases, is practically sold by the pure rule of luck.

It is surprising to observe what a difference the single factor of speed makes in the power transmitted. A shaft is driven by, say, a 20 inch belt on a certain-sized pulley; by a comparatively slight reduction in the diameter of pulleys, it will require two belts the width of the first one to re-transmit the power received by the first shaft to other lines.

Again, the limits of strength are varied by conditions as numerous as those pertaining to widths. With a single leather belt, laced, for example, the driving force depends upon the surface of contact and pressure of the belt on the pulleys. The pressure depends upon the weight of the belt. The weight for any assumed width depends upon the length. The length that can be employed depends upon the working strain, added to the weight that can be held by the lacing, without too large an item of repairs. We may cut out the lacing rivet and glue the belt together, and then look for our limit in the strength of the laps. The laps growing weak, take off the single belt and put on a double one. Now the weight is doubled, the driving force on the pulleys is increased and a greater load can be driven; but the first thing we know, the pressure on the pulleys caused by the long, heavy belt, is resulting in more loss in friction of shaft bearings, than is gained by the increased driving capacity. The horse power transmitted is increased to be sure, but the means by which the addition is accomplished appropriates more of the addition than is exerted for the benefit of the owner of the belt.

By way of benediction to the belt subject, the writer will mention the result of a formula that may be found in a very prominent "pocket book," by a well known engineer. The result of the formula amounts to the assertion, that a belt to transmit 75 H. P. must have a width of $45\frac{4}{16}$ inches, the pulley given, and presumably the smallest one being 72 inches diameter. There is no factor of speed in the calculation. Now any mechanical engineer, prescribing a belt of the above dimensions, to drive 75 H. P. would be liable to be charged with receiving a *very* large commission from pulley and belt manufacturers. It is to be hoped that the author of the work in question will recognize the "result" of his formula, and correct in future editions, either the remarkable misprint of a whole operation, or else his own mistake. There are numerous other formulæ at hand, but one is sufficient for the present.

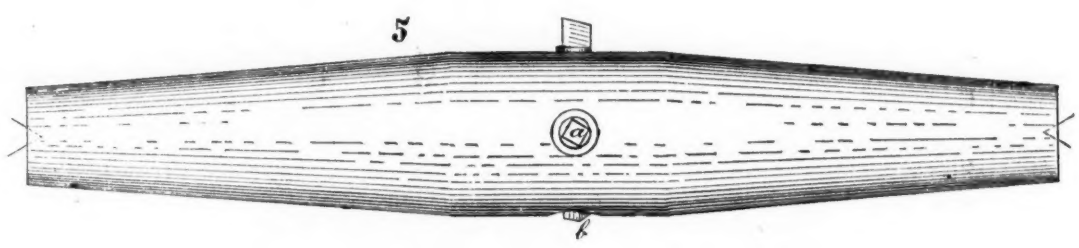
Thus we might continue to investigate with indefinite results; but with the view of keeping the volume of the present writing within bounds, we will examine but one more specimen, viz.: Steam and steam engines. The first thing to be observed is that the speculation is divisible and sub-divisible into numerous classes; but, unable to grasp them all at once, we will select the single item of "lost heat," and glance at the inconsistency that appears to exist, even in the so called 'best practice."

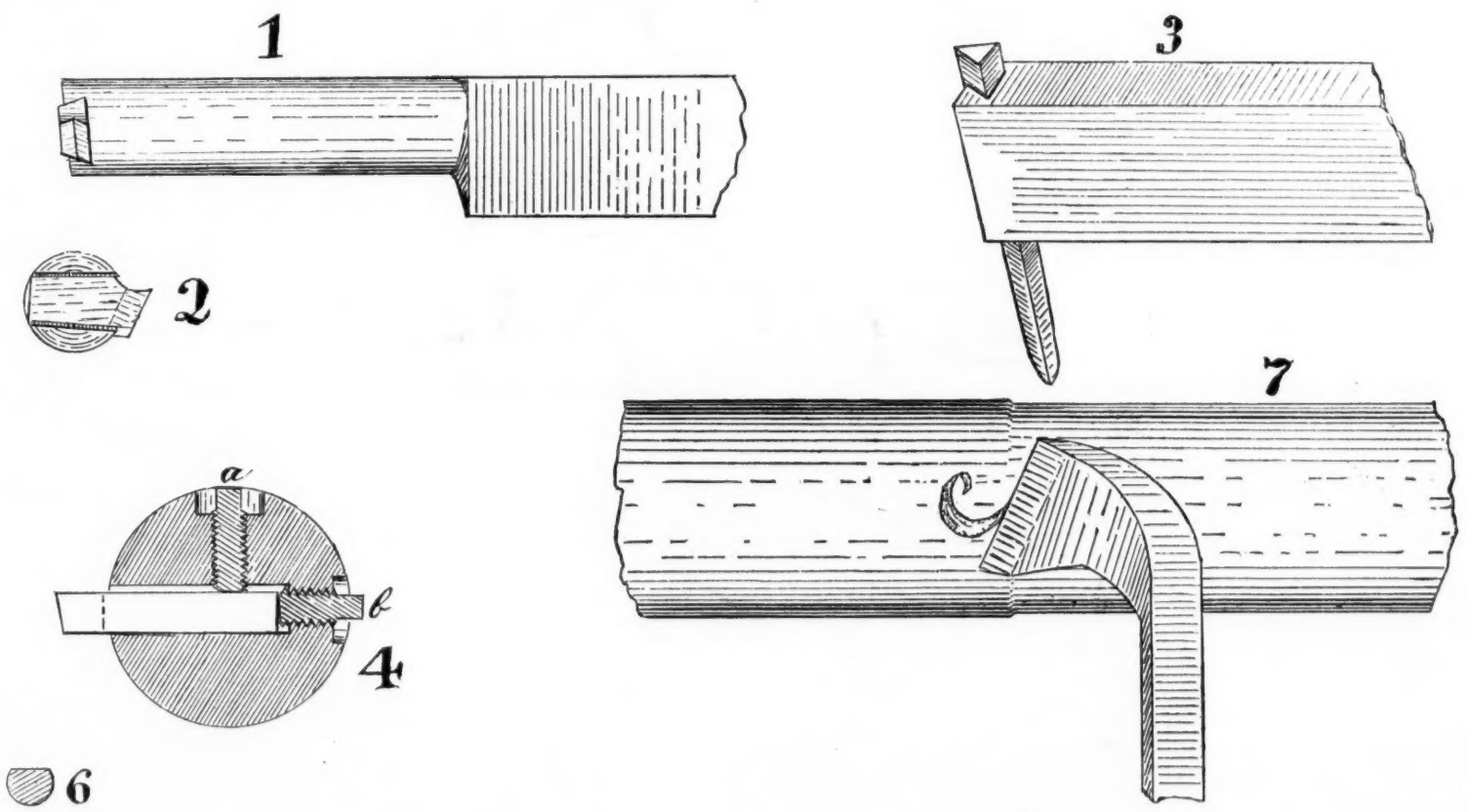
Mechanical engineers engaged in constructing steam engines, apparantly accept, as fact, the laws of heat and motion as generally recognized; but when we inspect the engines they make, discrepancies between the law and practice are discovered, which are very apt to lead one to wondering if there is any such thing as following out an idea, in a simple logical manner.

No sane man would think for a moment of allowing a great volume of cold air to rush through a room that he was endeavoring to heat to a temperature 100 degrees higher than that of the air. But one of our most prominent engine builders, has for years provided his cylinders with a partial jacket of moist steam of low temperature; the jacket extending the whole length of and about a quarter round the cylinder. There is a type of his machine now made, however, in which the above refrigerator is entirely discarded. The thing is done with little or no addition to cost of cylinder casting, and no increase at all in work of fitting up. The improvement is the result of an application of plain common sense, to the question of heat economy.

There are in existence to-day many engines with their cylinders almost completely surrounded by a belt of damp, cool exhaust steam. The intention of their makers was probably to "keep the cylinders warm;" never doubting because exhaust steam was hot enough to take the skin off their hands, that it would certainly protect the cylinders from loss of heat.

Before closing we will note one more victim. There is an engine, and a good one too, built not a thousand miles from Ohio, that possesses some very peculiar features. Its builders and advocates apparently do not believe much in the "rapid transmis-ion of heat;" do not go very much on re-evaporation in the cylinder; but charge most all discrepancies in cylinder action, to leaky valves. They adhere to high piston speed, endeavor to keep the cylinder hot enough to prevent condensation, and are rather proud of the indicator diagrams they can exhibit. Altogether they produce a substantial, good appearing engine, but after all, the oversight is committed, of passing the "live steam" through a "traveling steam chest," almost surrounded by an exhaust jacket. In some engines the exhaust jacket is *partially* compensated for, at least, by a jacket on opposite side of the cylinder, through which passes the steam from the boiler; but in the case of the motor with the hollow main valve, the steam from the boiler never gets a fair chance at the cylinder. Remarks have been made to the effect, that these engines show symptoms at the stuffing boxes of condensation to a considerable extent, even when good dry steam is used.





Hints on Lathe Tools.

BY WILLIAM MAIN.

It would be difficult to contrive a lathe tool, useful, and at the same time new to everyone.

The tools sketched herewith are certainly useful, easily made, and some, if not all, will be new to the great majority of the readers of the AMERICAN MACHINIST.

The advantages of lathe tools with moveable points are, theoretically, so obvious that a number of contrivances of this kind are to be found, in mechanical books at least, if not in the workshop. They are, however, neither easy to make nor always reliable.

The ordinary tool for inside work is often troublesome, as every latheman knows. In enlarging small and deep holes the point must be short and the shank long and slender. The tool spring makes a tapering hole, and the point sometimes breaks off, causing a rise of the moral safety-valve, and an escape of profanity, which by the use of the little contrivance shown in Figs. 1 and 2 might have been saved, as Mark Twain would say "for other irritating occasions."

The end of the round shank has a dovetail groove filed in it, somewhat narrower at the back. The end is also inclined a little to give relief to the cutting edge.

A short strip of steel is fitted to the dovetail and the projecting end sharpened as desired, either for screw cutting or for other work. The pressure of the work keeps the cutting point as firmly in place as if forged solid, while it can be loosened with a rap or two and changed or sharpened. As it wears away a thin slip of metal can be put on the side of the groove, making the point to stand further out.

The flat steel of which the point is made is of more uniform quality, and is already better compressed than the point of the common tool is likely to be, as it comes from the forge. The inner edge of the common tool is hard to grind on the average grindstone. With the movable point the shank can be made much stouter and the spring reduced.

Fig. 3 shows a similar contrivance for screw cutting or plain work. The end of an old three-cornered file is ground smooth and fitted into the end of the tool. It may be raised as it wears by a slug of metal at the back or side. The angle is right for a V thread, or the point can be rounded, &c. The temper of the file may need changing.

Figs. 4, 5 and 6 show the construction of a boring-bar, quickly made and effective. The body is of cast-iron, tapering toward the ends. A hole bored through the middle of the bar is enlarged three fourths of the way to fit the cutter, a short piece of round steel flattened on one side (Fig. 6.) A set screw *a*, at right angles, bearing on the flat side, holds the cutter in place and from twisting. The set screw *b*, is used to adjust and advance for a new cut. It is obvious that several cutters may be put in.

Fig. 7 represents a tool for wood turning, to fit in the tool post, and do the work of the common flat chisel in finishing off plain work. The cutting portion of the edge should be about on a level with the lathe centers, and the chip taken very light. When properly used it will leave the work perfectly smooth and true.

Annealing Steel in Boiling Water.

In a series of articles entitled "Studies in Sheffield," by Prof. W. M. Williams, appears some interesting information regarding the annealing of steel in boiling water. He says: "I will narrate some curious experiments that I commenced when in Sheffield, but have not satisfactorily completed. They were made at the suggestion of Mr. William Bragge, then a managing director of Sir John Brown's works. He had learned that the steel wire strings of piano-fortes are annealed by what appears a very anomalous process—viz., by making the wire red-hot and then plunging it into boiling water. Ordinary experience would suggest that this must harden the steel in some degree, but I tried it upon many samples of steel—mild Bessemer steel, sheer steel of different qualities and the hardest, old-fashioned Sheffield 'pot-steel'—and found that in every case, when the operation was properly performed, the steel was remarkably annealed. I compared samples cut from the same bar—one heated and slowly cooled by burying in ashes under a furnace grate, the other by immersion in boiling water—and found that when subjected to bending tests those which had been cooled in the boiling water would bear a more severe degree of flexure without cracking than the pieces which had been more slowly cooled in the ashes. They were not so soft, as tested by the touch of the file, but unquestionably tougher and more reliable when subjected while cold to violent bending blows of a hammer. It was more effectual than any device of 'oil toughening' or slow cooling I have had opportunities of testing.

Certain precautions are necessary. In the first place, the water should be quite at the boiling point and the steel at a bright red heat; and, secondly, the steel should be fairly surrounded by the water. These conditions being fulfilled, the steel remains red-hot under water for some time. It is evidently surrounded by a film of vapor, and is not in actual contact with the water, which assumes the so-called 'spheroidal state,' continuing in this condition until the metal has cooled considerably. I suspect that the toughening is due to the uniformity of cooling thus effected. I commend this method of annealing or toughening to the attention of manufacturers engaged in the production of all kinds of steel that is to be used for purposes where tenacity rather than hardness is demanded.

Improved Drilling, Slotting and Boring Machines.

One of the engravings shown on this page represents a combined drill and slotting machine, as constructed by the Ames Manufacturing Co., Chicopee, Mass. There are four sizes of this machine working to 11 inches, 25 inches, 44 inches and 52 inches diameter respectively. The 25-inch drill and slotter is also made with a double table, in place of single table, represented in the cut, that can be operated two ways in and out from the columns and crosswise at the same time. By this arrangement pieces can be fastened to the table and moved to different positions under the operating spindle, without loosening the work from the table. By having drills suited to the operating spindle, this machine can be used for milling irregular forms, such as is usually done in a regular die-sinking machine. The weight of machine is thereby increased 300 lbs.

The traverse drill and horizontal boring machine also made by the Ames Co. has a bed eight feet long, diameter of spindle 1¾ inches and traverse of same 12 inches. It is made either with or without power feed. The adjustable table is 40 inches long by 20 inches wide, and has a cross traverse motion, operated by rack and gear, of 22 inches. The surface of this table at its lowest point is 14 inches from the center of spindle; it has a vertical movement, operated by a screw, of 14 inches. The foot-stock is bored for a bushing to carry a bar when used as a horizontal boring machine.

Moral Power of Machinery.

Machinery has a moral power. It has helped build up substantial character in the nation, has broadened and made sensible the views of men, and removed much silly pride far more strikingly than could anything else. It has shown work, physical as well as mental, to be of paramount importance, to possess inherent elevation of the highest kind, and to be not only respectable, but honorable in the extreme. Thus it has enhanced activity among individuals who work from choice, while those inclined to be idle and to nurse the shallow aristocratic notion, which before the advent of labor-saving machinery considerably prevailed, that the less a man does of useful labor, the more he can lay claim to the character of a gentleman, have been stimulated to exertion, as they saw work, on a grand and powerful scale, embodied in machinery, and noted the tremendous results accomplished before their eyes. As we said, the people have not clearly recognized the influence, but they have instinctively felt its moulding.—*Manufacturer and Industrial Gazette.*

Electricity Transmitted Through Pipes.

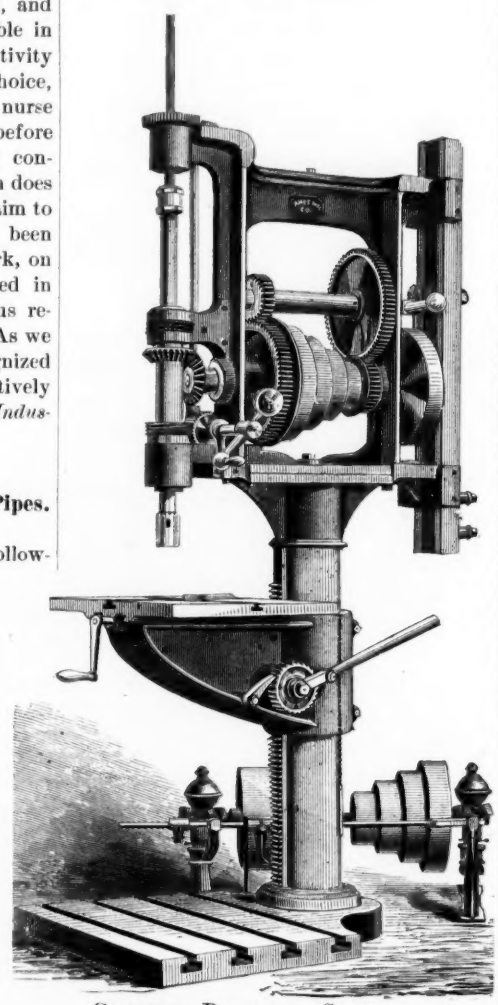
The *New York Herald* publishes the following among its cable dispatches from Paris:

"A French engineer named Parodi claims to have discovered a method of conveying large quantities of electricity over long distances, and distributing it at any number of points on the way exactly like gas or water. Electricity of sufficient tension is produced in the ordinary manner, but instead of transmitting it by the usual wires or cables it is conveyed through immense continuous truncated pipes, having the same qualities as Leyden jars. The tension is uniform throughout, and it is thus possible to divert the fluid as may be required at different points, for various industrial purposes. The invention dispenses with steam engines. Steam may be replaced by waterfalls, thus great economy in the production of electricity is effected. The inventor believes that Niagara might be utilized and electricity transmitted from the Horse Shoe Falls to New York or Boston."

Coiled springs of steel wire may be tempered by heating them in a piece of gas pipe, in which they are packed with bone dust or animal charcoal, precisely as though they were to be heated for case hardening When sufficiently heated–that is to a deep red—remove the spring, or plunge the spring and its receptacle together into a bath of animal oil. The spring is to be tempered by putting it in a shallow pan, with tallow or animal oil, over the forge fire, and agitating the pan and its contents until the oil takes fire. Take the springs out, and when the oil is burned off cool them in water.

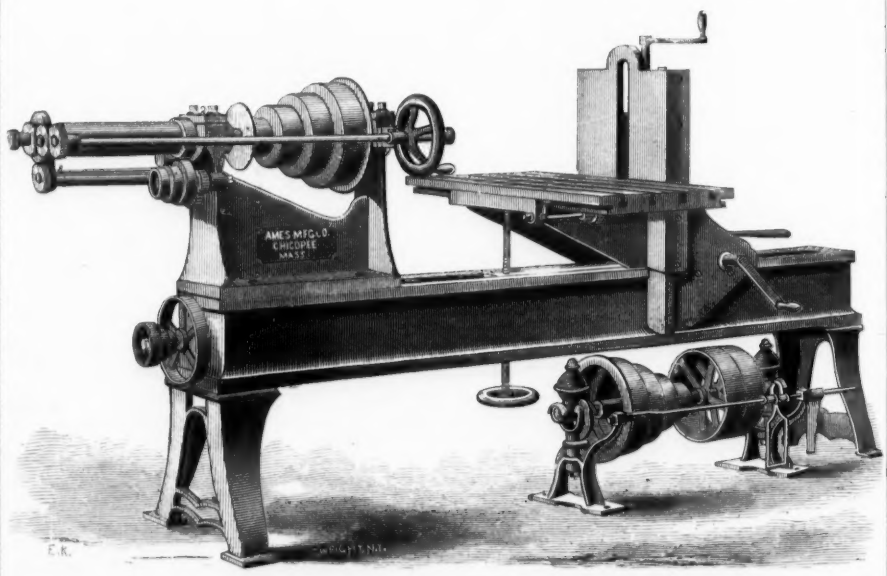
Metal Vessels Lined with Sheet Tin.

A French firm has for some time past been lining metal vessels with tin, so that they can serve for liquids which otherwise could not be left long in contact with them; as, for instance, the vats used in breweries, distilleries, vinegar manufactories, and many other industries, as well as for domestic purposes.



Combined Drill and Slotter.

The sheets of tin are rolled to the required thickness and superficial dimensions, and are then attached to the metal (copper or iron) by a patented process. In this manner the metal of the vessels can be taken lighter. As it will not lose by oxydization, considerable expense is saved, as there is no necessity to have recourse to the often repeated tinning in the old method. Even old and partly damaged vessels can thus be made useful again. In cases where vessels lined in this manner are placed upon the fire, the only precaution necessary is never to leave them without water. The use of such vessels, from a sanitary point, is not the least of their merits.



Traverse Drill and Horizontal Boring Machine.

In accordance with the report of a special committee of citizens of Kingston, N. Y., a bill will be immediately sent to the Legislature authorizing the city to appoint twelve Commissioners and bond the city for $250,000 to build water works.

New Welding Process.

Herr Krupp, of Essen, says the *Universal Engineer*, has recently patented in Germany a method of welding tubes and tires, which is based upon an excellent idea. He draws the tube over a pair of ordinary rolls, and heats the whole length of the portions to be welded by a special contrivance, which is a portable fire-box into which air is so blown that the heat is directed against the weld. After the necessary heat is attained, the rolls are set in motion and the place to be welded is repeatedly drawn through them. His heating apparatus could, probably, be replaced to advantage by some gas apparatus, similar to that used for heating wagon-tires in America and in France.

Malleable Bronze.—According to a recent German patent, taken out by M. Dronier, malleable bronze may be obtained by the addition of a small quantity—from ½ to 2 per cent.—of mercury. It may be added to either of the metals of which the alloy is to consist (being poured into the fused metal and stirred with it); or it can be introduced along with the tin, or soon after it, into the copper bath.

Rawhide is said to make good journal boxes for machinery. A practical machinist says: "I have run a piece of machinery in rawhide boxes for fourteen years without oil; it is good yet, and runs at 4,500 revolutions per minute. I put it in, while soft, and let it remain until dry."

A New Gatling Gun.

According to the London papers, all the most terrible and deadly weapons of war hitherto introduced appear to have been thrown into the shade by an improved Gatling gun, which was exhibited recently by Dr. R. J. Gatling to a number of experts, at the offices of Sir William Armstong & Co. This weapon is capable of firing 1,000 shots per minute, and killing a man or a horse at a mile range. The gun has a compact appearance, can be taken to pieces, and easily carried about, can be applied to military or naval use, and the mechanism of it is simplicity itself. The revolving barrel has ten compartments, into which, as they whirl round, metal cartridges drop from a tall oblong case fixed over the center of the barrel. At each turn of the handle ten shots are fired, and their dispersion is accomplished by a sliding apparatus. The size of shot in different caliber guns of this class ranges from musket balls to half pounders. By the use of this implement, three men can do the work of 300 riflemen. A quarter of a million dollars are said to have been spent on experiments necessary to perfect the gun, which is now regarded by military experts as a complete success.

Steam Cars.—*Le Voltaire* reports on a most interesting experiment recently made at the "round-point" in the Champs Elysées in Paris with a new steam carriage. This new vehicle will prove invaluable in country places where local interests do not warrant the formation of a railway. It consists of an omnibus with outside accommodation for 40 passengers. The engine is in the rear, in front is a platform, where stands the conductor, and there is room for five or six persons. This engine, of 40-horse power, will drive a wagon with a load of a couple of tons at a rapid rate up steep hills. The engine is easily worked, and can be slackened or pulled up with the utmost promptitude. On the morning of its trial it traveled for three hours at an average speed of 20 miles an hour. In the middle of the Avenue Montaigne, when at high speed, M. Rousseau, Director of Public Works, expressed a wish to see how quickly it could be stopped. M. Bollée, one of the inventors, who was steering and regulating the speed, applied the brake, and the vehicle stopped at once. It was ascertained that during its run of three hours it consumed 220 gallons of water and 110 lbs. of fuel.

Work Holder for Lathes.

The object of the work holder illustrated in the three engravings on this page is to hold small articles in the lathe while being acted upon by a revolving cutter turning upon centers. It is secured to the carriage in the same manner as the ordinary cutting instruments. This device is not intended to supersede shaping machines, but is designed as a convenient and comparatively cheap arrangement for performing in a lathe the work of a milling machine and a planer, on a reduced scale.

The device is adapted to fluting taps, slabbing studs, nicking screws, and other similar work, in great variety.

The three combinations of the invention are shown in the engravings. In Fig. 1 the work is so held as to extend across the bed of the lathe at right angles to the arbor.

In Fig. 2, the cutter acts perpendicularly downwards, as in the case—nicking the screw head—shown, while in Fig. 3, the axis of the article under operation is parallel to that of the lathe. *A*, in all the figures, is the bar, which is clamped in the ordinary manner in the tool post, and *B*, the clamping band which secures the work. These parts remain the same in all the adjustments of the instrument, the only portion changed being the jaw *C* and its arm *D*, in manner and for purposes below set forth. The bar *A*, is provided at one end with a vertical groove *E*, Fig. 1, in which slides a tongue formed on the arm *D*. The top of the latter is turned over the portion just described, and is provided with a screw *F*, (all figures), which turns down upon the top of the bar. *G* is another screw bolt, which passes through a slot in the end of the bar *A*, and enters the jaw *B*, holding the tongue of the latter in the groove, and sliding up and down in its slot. It will be seen that by loosening the screw *G*, the jaw *C* may be set at any desired elevation, and then, by clamping said screw, be nicely adjusted by a screw *F*, which also serves to secure it at a given point. The screws are turned by the wrench shown, which fits all the heads. The clamping band *B* also has a screw *H*, passing down through its top and pressing upon the jaw *C*, so as to draw up the lower inside end of the band toward the under side of the jaw, and hold firmly articles inserted between them while being acted upon by the revolving cutter, as shown in Fig. 1. The extent of the operation is regulated by the movement of the tool carriage, and the sliding arrangement of the jaw *C* upon the bar *A*. The lower part of the band *B* is enlarged so as to permit the insertion of larger articles than would the portion sliding upon the jaw *C*, and is strengthened by the rib I.

Fig. 1

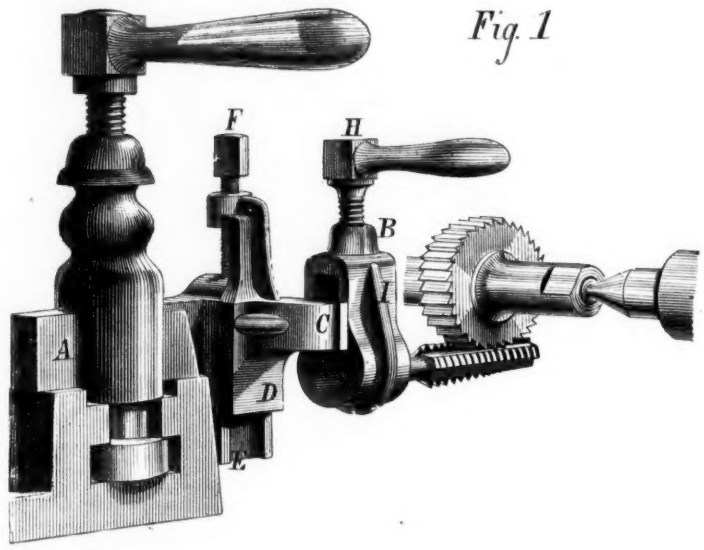


Fig. 2.

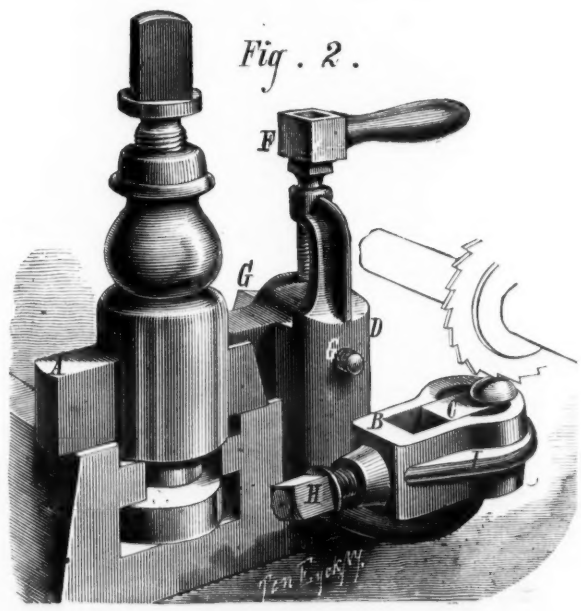
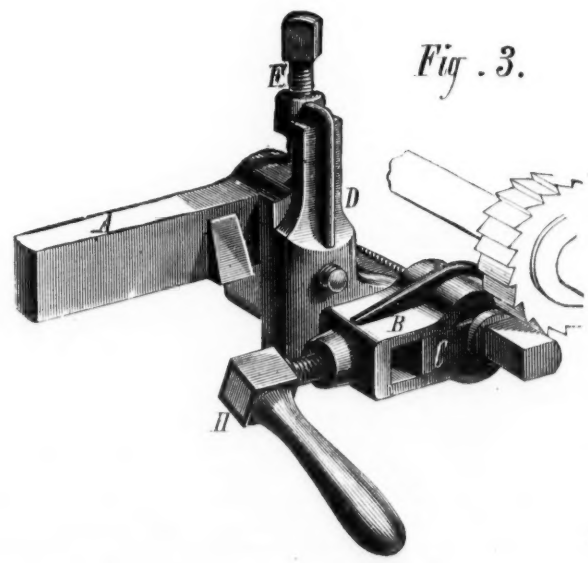


Fig. 3.



The difference in the form of the instrument lies simply in the construction of the jaw *C*, and arm *D*, necessitating three separate pieces, either of which may be used in connection with the bar and clamp, according to the kind of work to be operated upon.

In Fig. 1 a tap is being fluted, in Fig. 2 a screw nicked, and in Fig. 3 a square head formed upon the tap. Any one who has ever attempted to flute taps on a planer is well aware that the tool jumps along from thread to thread, and the result is at best anything but satisfactory. By this device the tap can be turned and then fluted on the same lathe, thus necessitating no interruption of either planer or slabbing machine.

This device has been in use for several years, giving good satisfaction. It is manufactured by Jackson & Tyler, Baltimore, Md.

The locomotives on the Pennsylvania railroad use 30,000 tons of sand annually.

The Syracuse *Herald* says: "The locomotives on the New York Central Railroad are to be remodeled and a new attachment, consisting of a projection of the boiler in front of the smoke stack, is to be adopted. This projection will catch all cinders and sparks and prevent their escaping from the smoke stack. Engine No. 280, the William H. Vanderbilt, which usually draws President Vanderbilt's train when he goes over the road, has just come out of the shops, after having this new attachment added to it, and being otherwise thoroughly overhauled. During one year this engine ran 92,647 miles, and was not in the shops once." We may add that the cinder-catching device has been in use for some years on the N. Y., N. H. & H. R. R., with good results. There is no good reason why it should not be adopted on other roads.

DRILLING GLASS.—Stick a piece of stiff clay or putty on the part where you wish to make the hole. Make a hole in the putty the size you want the hole, reaching to the glass of course. Into this hole pour a little molten lead, when, unless it is very thick glass, the piece will immediately drop out.—*Design and Work.*

MAGNETIZATION OF CAST IRON.—Mr. E. Chernoff has succeeded in the curious experiment of magnetizing cast iron by surrounding the mould in which the bar was cast by an electro-magnetic reel, along which a current was allowed to flow during the casting process, so that the liquid metal became magnetic and cooled under the influence of the magnetic current. The result was a magnetized bar of white cast iron, but having a symmetrical cavity, extending about two-thirds of its length, the metal being extremely thin just opposite the center of the reel. While pouring in the metal, and until it had set, the experimenter had noticed a singular agitation of the metal; and the hollowness of the bar after setting is explained on the theory of the repulsion of the molten metal towards the poles, the agitation above noticed being a visible evidence of this action. It is suggested that powerful and permanent magnets of cast iron may be obtained in this way by casting under pressure; and that by some modification of the experiment, the plan of magnetizing the fluid metal might be usefully employed in casting hollow cylinders without cores. Further experiments will be looked for with especial interest.

The Massachusetts Charitable Mechanics' Association of Boston have voted to purchase a lot on Huntington Avenue and Newbury Street, on which to erect a permanent exhibition building. The price is $1 per foot.

Steel vs. Iron Built Vessels.

At the annual meeting of the Institution of Naval Architects, held in London, Mr. W. Denny, the eminent Clyde Shipbuilder, read a paper—"On Steel in the Shipbuilding Yard." The author's purpose in this paper was to give an account of some of the experience his firm had had in the use of mild steel during the last two years. It had first been used during the blockade-running period; but the material as then made being far from satisfactory, the result was not encouraging. The first time his firm had employed the mild steel now in use was in a light-draught paddle-steamer, the *Taeping*, which on one of her earliest trips ran upon a snag and came off safe and sound, while an iron vessel would probably have gone down under the same circumstances. Of the steel now supplied to them they had little cause to complain, except from uncertainty of delivery, probably occasioned by the newness of the works. Referring to some recent vessels built of steel as compared with those of iron, he said they had shipped six small steel steamers without losing anything by breakages, than which he thought nothing could have better shown the comparative reliability of iron and steel as a shipbuilding material. Indeed their whole experience led them to look with confidence on the steel and with doubt on the iron, and their workmen held this view of the matter very strongly. The only danger was from working at a black heat. Mr. Denny next referred to experiments bearing on the loss of strength in steel plates from annealing, on which account his firm had preferred the practice of rimelling punched holes, where such were required, to annealing the plates. With regard to the tensile strength of the plates, Lloyd's conditions were that it should not fall below twenty-seven tons, nor exceed thirty-one tons to the square inch; but he asked if it was necessary that they should restrict themselves to such very mild steel, as an increased tensile strength would greatly help the rigidity of the steamers, without any accompanying troublesome consequences? There were four matters of doubt and difficulty in the future of steel; the poor delivery yet attained by the steel-works, the practice adopted by Lloyd's of testing in the yard after delivery, the supposed greater liability of steel to corrosion, and the doubts entertained of its reliability and safety. He stated several important objections to the present testing arrangement, the removal of which, however, he believed to be under consideration; and as to corrosion, he believed the cause to be purely local and exceptional. In conclusion, he was of opinion that the supersession of iron by steel in ship-building was a mere question of time, and that its steadily lessening proportionate cost would undoubtedly hasten the change.—*Engineer and Iron Trade Advertiser.*

Mr. Edward S. Cook, formerly of Trenton, N. J., and Mr. Peter F. Collins, who is known in connection with Brazilian railways, have contracted to build a railroad to Anglesea, the new summer resort, about five miles from Cape May. Ground is to be broken at once, and sufficient force will be employed to finish the road in 60 days. Anglesea bids fair to rival Cape May City as a popular sea-side resort.

The Narrowest Gauge Railroad.

The prismoidal railway of San Joaquin, Cal., is a curiosity. At an exhibition of its working it gave such satisfaction that it promises to lead to the construction of 250 miles of track, which will bring to market vast crops of wheat now excluded by cost of transit. This is a single rail, elevated on prism-shaped planking. The cars are steadied by side wheels bearing horizontally against both sides of the prism. The cost of construction is not a fourth, and the freight is expected to be $2.25 as against $6.50 the ton of grain, the speed one-half, and the bulk of tonnage will be outgoing and uneven on distribution, calling for care in estimating contingencies.

An engineer on the Lehigh Valley road, says the *Railroad Gazette*, broke the valve of his whistle-pipe the other day, and to save his life could't stop the shrill screaming that followed. The prolonged whistling caused much commotion among people living along the line of the road, and many ran from their homes to ascertain what was the matter. The engineer pointed to the whistle, which the fireman was vainly endeavoring to fix, but the gestures were not understood. Stationmen, flagmen, trackmen and others had an idea that the engineer was crazy, and began to predict all sorts of disasters. The engine was run to Sugar Notch and housed, and there the fire was drawn. All this time, and until the steam was exhausted, that insatiable whistle tooted away like mad. It was a funny sort of an accident, and created quite an excitement.

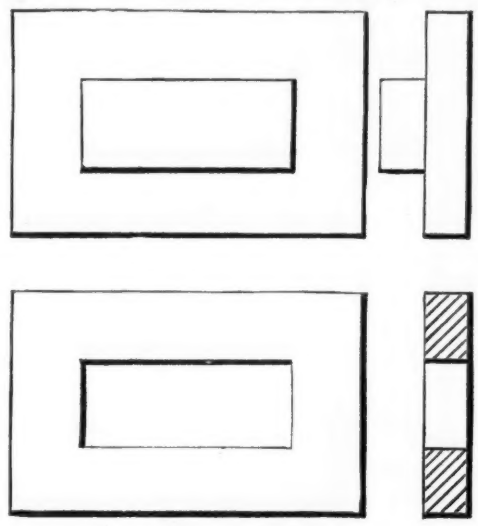
Practical Draughting.—Observation—Geometrical Principles—The Use of Shadow Lines, and Where to Place Them.

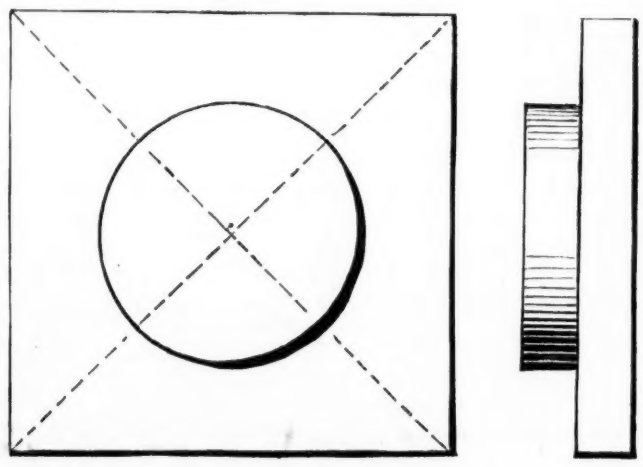
BY T. P. PEMBERTON.

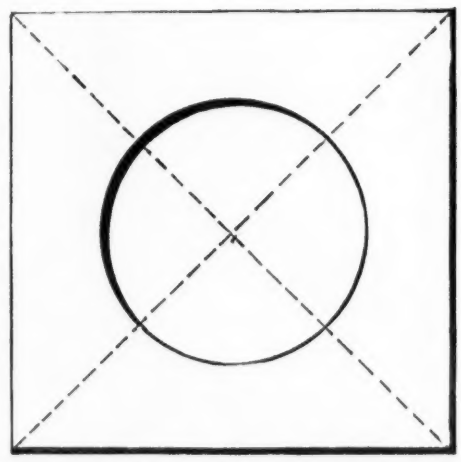
Explanation having been given respecting the instruments and drawing materials required by those who are desirous of becoming expert in making construction drawings, as well as highly finished pictures of buildings and machinery, we proceed to consider some elementary exercises in mechanical drawing. And, first, attention is called to certain geometrical definitions and principles which, simple as they are, and probably familiar to most, should be constantly retained in the memory. Note the great variety of surrounding objects and their many different shapes, some large, some small. Here is a body of a single material, it may be of cast or wrought iron, brass, stone or wood; there is another, constructed of various materials. Note, again, the many forms in nature and constructive art—of leaves, flowers, shells and minerals; of houses, public buildings, machinery, household goods and ornamental pottery. It is possible to represent these and all other objects on paper in outline by pen, or pencil, or brush. In the room where you are reading this, you will observe the difference in form between walls and tables, between chairs and windows, books and lamps. Now, there are only two kinds of surfaces, plane and curved. The edges of surfaces are *lines*. There are but two kind of lines, straight and curved. There are but three kind of straight lines, horizontal, perpendicular, and oblique. The edges of the pages of the AMERICAN MACHINIST are lines. A postal card shows two plane surfaces, two horizontal and two perpendicular lines. A draughtsman's drawing triangle has plane surfaces, perpendicular, horizontal and oblique lines. So all objects having plane surfaces are bounded by lines; the surfaces are terminated by lines. These lines, mathematically speaking, have length only, no breadth, no thickness. You cannot cut off or plane off a line. A line, therefore, is the edge of a surface. Examine architectural and mechanical drawings, and you will find that they are made up of curved and straight lines, which, in outline, *represent the edges of surfaces*. The form and shape of any plane surface is according to the direction of its edges. The fewest number of straight lines that will make a figure, or the shape of anything, is three. You cannot make the shape of anything with two straight lines; with a curved and a straight line you can.

The student should, at the very outset, learn to sketch, and sketching, in practical draughting, consists in representing objects by means of pen, or pencil, or chalk, without the aid of instruments, and writing on the sketch the dimensions obtained by rule and calipers. In the annexed figures, it will be observed, that some of the lines are much broader than others. And just here it may be remarked, that the expressions "heavy," "thick," (lines) which appear in some works on drawing, are incorrect. It is correct to speak of fine lines, broad lines, but weight and solidity are scarcely applicable to such delicate work as geometrical delineation. In "Lessons in Mechanical Drawing," written by an eminent professor, who should be a good authority, these terms are used without distinction; heavy, meaning a thick line, and a thick line meaning a heavy one. But to return to the broad lines. What are they for? Where are they to be placed? These broad lines are termed shadow and shade lines, and are, so to speak, the language of a drawing, They serve to show where shadows would occur from the objects themselves; they serve to show what is solid and what is hollow; what is a projection, and what is an opening; what is a raised surface, and what is a panel or recess. The shading lines show the curvature of a surface, whether it is convex or concave.

Light is supposed to fall at an angle of 45°, and to come from the upper right or left hand corner. Where the light falls the lines are left fine, where shadows would occur, the broad lines are introduced. The illustrations represent an oblong slot in a block, a circular hole in a plate, a projecting piece, and a circular "boss" on a plate. The student will observe that *in the openings* the shadow lines are the reverse to those on the raised surfaces. The circular shadow line is obtained not by turning the ink bow pen backwards and forwards, but by keeping the radius of the circle in the opening of the pen and taking a new center just inside the first one.







The Yates City (Ill.) *Banner*, says: "John Hensler, a native of Sweden, has been in the employ of the Chicago, Burlington & Quincy Railroad for 25 years, first at Galesburg, and afterwards in Yates City, in which place he has been for 18 years. His business is to test the car wheels by tapping them with a hammer. The first 12 years he was here he found an average of 12 cracked wheels per year; the next three years an average of 8 per year, and for the last three years he has found none. During the 18 years he has been in Yates city he has tapped, in round numbers, 10,000,000 car wheels. No accident can be attributed to his carelessness, and no wheel has broken between his point and the next, which is Peoria and Galesburg."

New Way of Heating Railway Carriages.

It is reported from Lyons, says the *English Mechanic*, that the Companie Paris-Lyon-Méditerranée is now trying a new method of heating in express trains. The method was proposed by M. Ancelin, an engineer, and consists simply in the use of acetate of soda in the foot-warmers. The substance has considerable latent heat; dissolving at a certain temperature, it thus absorbs a large quantity of heat, which becomes sensible during crystallization in cooling. All that is required is to fill the ordinary cases with a sufficient quantity of the acetate, close them, and place them in a stove at about 100°. The cooling of a case thus charged and heated takes 12 to 15 hours. The warmers are thereafter taken from the compartments and placed in a stove (where the crystals of soda acetate are re-dissolved); they are then ready for fresh use. The advantages of such a system are obvious—no necessity of changing warmers every two or three hours, or of maintaining a numerous body of men at stations to attend to them, economy in cost of heating, &c. Moreover, most of the existing foot-warmers can be utilized. Acetate of soda is not very expensive, and it could easily be manufactured in much larger quantities than at present if the demand required it. The new system has been tried on the express train No. 5, leaving Paris at 7.15 and reaching Perrache at 4.31. The compartments were each supplied at starting with two warmers containing acetate of soda. At Perrache most of the warmers were still so hot that one could not apply the back of the hand to them. From Lyons to Marseilles the train was heated on the ordinary system.

Mechanic's Lien.

After an iron mill had been in operation for many years, the plaintiffs furnished new boilers therefor, and placed them in a substantial new building, erected a short distance from the main mill, with which it was connected only by means of steam pipes. A mechanic's lien was filed against the entire works for the value of the boilers, etc., furnished to the one building. *Held*, that where the materials or machinery have been furnished to a new building, intended to be used in connection with an old manufacturing establishment, the lien should be filed against the new building only, and not against the entire works.—*Wharton Bros. & Co., vs. Douglass & Son, Supreme Court, Pa.*

Detroit is also to have a glucose factory, the Michigan Grape Sugar Company having been formed with a capital of $250,000, which is already putting up extensive buildings, and intends eventually to employ 150 men, making 3000 bushels of corn into forty-five or fifty tons of sugar and syrup daily.

I hav finally got so that I ain't at all sertain ov what I kno miself, and am gitting less sertain ov wat others say they kno.—*Josh Billings.*

Letters from Practical Men.

BEARINGS FOR MACHINERY.

Editor American Machinist:

It seems to me that Chordal is inexhaustible, and must have lived about three times the average life of a practical machinist. His treatment of every subject connected with the practical working of a machine shop is simply marvelous. He hits the nail on the head every time. There is everything in knowing how to tell what you do know, of course (and he knows this part of his business exactly); but aside from this, one must have had the practical experience (and not take his points from others) to be able to write such letters. He beats himself every time. Now, in his last letter, his discussion of the subject of bearings is right to the point, but he leaves off by telling us that, "if he don't forget it," he will give us his idea of proportions, material, workmanship, etc. I do not wish to take up the subject where he left off, for I know he can finish it much better than I, but I wish to show my approval, and confirm every word he says on this last-named subject.

I can assure Chordal that I have already come to the conclusion that a bearing made of proper material, properly fitted, and properly proportioned to the work it has to do, and properly lubricated with a good lubricant, free from grit, and which will not gum, will never wear even to a loose fit. The proper proportion will be just where the "little globules" will not flatten by the pressure. The proper fitting of a bearing is to have it free enough to get the lubricant between the bearing and journal, and have the bearing *fit perfectly over all*—not in places, perhaps not getting more than quarter of the benefit of the surface. Such a bearing will wear almost forever.

If I wished to make the best bearing I could, I would make both journal and bearing of cast-iron. I know about four out of five will cry out against this, and will cite plenty of instances where they have had no end of trouble with cast-iron bearings, but I will say that it is only where the bearing has been too small for the pressure put upon it, or badly fitted, or badly lubricated; one of these faults, and perhaps all of them, have existed.

Some good workmen, and men of experience, do not seem to comprehend the great value of making *perfect* surfaces in all metal bearings. A bearing 4×6, with one-half of the surface bearing, is no better, so far as wear goes, than one 4×3 perfectly fitted. Again, our particularly good workman will sometimes fit a bearing so tight that there is no room for oil between the surfaces. I have seen machines so fitted, and the consequence is that the bearings in the machine, on being started, begin to heat, and you can't stop their heating. Finally, it comes to a stand-still, with bearings stuck. This is called "breaking in." I contend that a machine should be built in such a manner that no breaking in is required; that it should run as free when first started as it ever will. This it will do, if the bearings and other surfaces are properly fitted; no grinding in, but a patient use of the scraper on every bearing, until the surfaces come together perfectly.

Regarding the necessity for leaving oil space, I recollect once of cautioning one of our men about fitting bearings too close, saying that he must leave space for oil. He replied that if I would tell him how I wished them fitted, he would try and suit me, but that his boss had cautioned him against making poor fits (as he called a loose fit). I told him to fit them so that when dry he could feel a little shake, at the same time having the surfaces smooth. (These were loose pulleys on a cast iron bearing in a planer). He fitted them up right, but didn't he catch fits from this particular, nice workman, the boss! Said that individual: "These fits are very poor, and you must make new pulleys, and never do so again." John didn't tell him it was my fault, but as soon as he found an opportunity he came to me, with terror in his visage, and told me the whole story. "Never mind," I said, "I will defend

you. Now, John, go and oil those pulleys, and then see if they will shake." John did so, when lo and behold there was no shake! The fit was perfect. This lesson he has never forgotten, but has related it all repeatedly, and now our men all realize that oil requires space, and our machines don't "bring all up standing" when first started, for the want of properly fitted bearings.

I have recommended cast iron for bearings. This is where the conditions are all right, and a careful man is in attendance; but for real rough-and-tumble hard usage, give me a well lined and well fitted babbitt metal bearing, I believe, after all, its virtue lies in its ability to fit itself to a perfect surface without abrasion. Perhaps you will think me putting it on rather thick, when I tell you that the crank pin on our engine has been running in babbitt lined boxes for fourteen years, the size being $3\frac{1}{2}'' \times 4''$ long, driving from 60 to 85 horse power, and the bearings have not been set up more than $\frac{1}{32}$ of an inch, but it is so. So much for babbitt metal bearings. I will stop here and give Chordal some space to tell us just how to proportion our bearings.

Respectfully yours,
F. A. PRATT.

Hartford, Conn., April 26, 1880.

BLOWING OFF BOILERS.

Editor American Machinist:

In your Questions and Answers, May 1, (3) you say: "It is customary to blow off under pressure," but you do not endorse the custom as a good one. Why this antiquated, ridiculous and unsatisfactory method of cleaning out a boiler is generally followed in this day of reason, it would be hard to conjecture. As you rightly say, the boiler is not cleaned thereby. If the boiler is unprovided with a hand hole, wait until the steam has condensed and a vacuum formed in the boiler, then let air in by the waste pipe. The violent entry of the air will thoroughly shake up the water and sediment, and as soon as the pressure within and without is equalized the dirty water may be allowed to run off.

It is sometimes convenient to let water in by the feed pipe and flow it off by the waste, thus cleaning the bottom out. If the waste pipe can be unscrewed from the boiler readily, a further means of reaching the sediment is presented.

JOHN T. NORTON.

Boston, Mass., April 27, 1880.

SECURITY FOR WORKMEN'S SAVINGS.

Editor American Machinist:

I was much interested by "Norman's" remarks on the question of Security for Workmen's Savings, in your issue of April 17. I think it a question worthy of the earnest attention of all true men. Those are the workmen's best friends who help them in order that they might help themselves.

I think all sensible men will admit that it would be a great benefit to American workmen to have Government security for their savings, and that such security would hurt no one who has a just or rightful business in society. Then why should we not have it? In monarchial England British workmen have such security in the Post Office Savings Banks, thanks to the exertions of Mr. Gladstone. Who will be the Gladstone of America, in this direction, and deserve the thanks of the American workmen for all ages to come? T. R.

St. Paul, Minn.

PHILOSOPHY OF THE STEAM WHISTLE.

Editor American Machinist:

There is a principle involved in the operation of the steam whistle that I have never yet seen satisfactorily explained, perhaps more from a lack of observation on my own part than otherwise.

Possibly, some one of the many readers of your valuable paper may have an idea that will help to throw light upon the subject. It has, of course, always been known that the steam issuing from the circular orifice immediately under, and impinging directly against the bell of the whistle, causes a vibration and produces the sound. But as to whether the sound is produced by the vibration of the bell of the whistle, similar to that of the bell in the church tower when it is struck, or whether the sound is produced by the vibration of the column of air contained within the bell, like that given off by the blowing with the mouth across the end of a tube closed at its other end, has, it seems to me, not so generally been known.

If the latter idea is considered correct, then it would be conclusive. But, if the former should be the more feasible, what is the mechanical operation of the steam upon the bell of the whistle to produce its vibration? It would seem to be produced by the constant and sudden change of the jet of steam alternately from the outside to the inside of the bell, caused by the vacuum, or partial vacuum, that would first be formed in the bell by the jet of steam exhausting the air, involving the well known principle utilized in the vacuum brake, injector, etc., and then refilling with steam, and so on, with such rapidity as to cause its vibration—therefore the sound. F. H. MORSE.

1176 Tremont St., Boston.

BURNING COAL DUST.

Editor American Machinist:

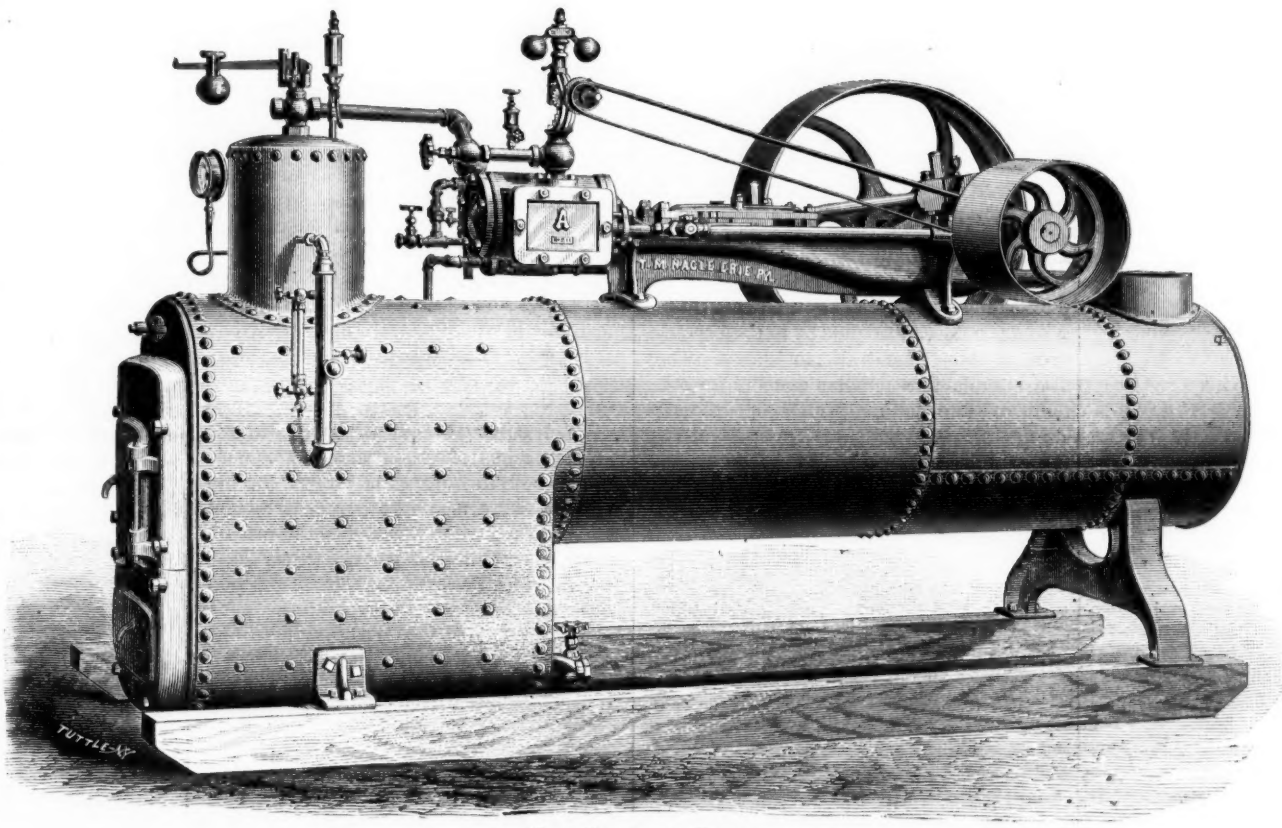
Having received much valuable information from your paper, I would like to give to others a little of my experience in burning coal dust under steam boilers, hoping it may be of use to some one. Our boiler is horizontal, 3 feet diameter, 15 feet length, 24 3-inch tubes full length of boiler, grate surface 14 square feet. It supplies steam to an engine, 9′x18′, which drives all the machinery of a large boot and shoe manufactory. The boiler also has to furnish steam to heat said factory, which is a three-story and basement, 40x100 feet, with 128 large windows, 5 outside doors, and 8 scuttles in roof, and stands in an exposed situation. The boiler also furnishes steam to an office heater, nearly 100 feet from boiler, to a dry box 50 feet from boiler, and to a steam stamping machine 12 feet from the boiler. I will give a comparison between coal and coal dust, both being used under the same boiler and by the same fireman—myself. The coal was used during the first 18 months the boiler was ever used; consequently was in the most favorable condition to secure good results, while at the time of commencing to burn dust, scale had accumulated to the thickness of 1-16th of an inch.

No. of tons coal burned	94½
Cost of coal burned	$567.00
Number of hours working time .	2698
Average cost of fuel per hour .	21c.
No. of tons of coal dust burned .	26¾
Cost of coal dust burned	$516.87
Number of hours working time .	6516
Average cost of fuel per hour, about	7¾c.

It is also worthy of notice that the capacity of the factory has been nearly doubled (since commencing to burn dust) by the addition of several new machines, all of which are run by power. If any of your readers wish further information on the subject I shall be pleased to hear from them, provided they enclose 2 three cent stamps to pre-pay postage.

Very respectfully,
WALTER F. SAGE, Engineer.

Milford, Conn., April 20th, 1880.



NEW PORTABLE ENGINE.

New Portable Engines.

The engraving on this page represents a style of portable engine now being made by T. M. Nagle, Erie, Pa. These engines, of which five sizes are made, are built from entire new patterns with a view to securing the latest and best improvements. The aim has evidently been to make all parts plain, simple, strong and durable. All the wearing surfaces are unusually large. The frames which are strong are shaped so as to carry off all the waste oil. All the cylinders have hot air jackets which decrease the condensation in cylinder. The arrangement of the steam chest and steam ports is such that all the water forming in the cylinder is readily carried off. The ports extending below the bottom of cylinders, and the heaters being still lower, a perfect drainage is secured. The heaters are independent of the frames and all the pipes are easily accessible. The pumps are large and simple, firmly secured to cylinders and it is claimed unable to get out of alignment. They are provided with large air chambers and brass valves and seats, which can be readily taken out and replaced while the engine is working at full speed. The cranks are large and made of solid forgings. The pistons are fitted with self-adjusting steam packing rings and, it is claimed, do not require any attention nor do they cut the cylinder. The connecting rods are of wrought iron, with straps, bolts and keys to take up the wear of the brass boxes. The general design of the engine is neat and compact.

The boilers for these engines are of the plain water bottom furnace style, of the most approved proportions. They have large furnaces with removable fronts, giving easy access to flues, &c., for thorough cleaning and repairs; fusible plugs in crown sheets which will melt in case of low water in boiler and allow the steam to enter into furnace and put out the fire. The water bottoms admit of free circulation of water, and, it is claimed, are a perfect safeguard against fire under the furnace and allow the sediment to settle below the line of the fire. Hand-holes are provided in suitable places, in addition to the blow-off valve, to give easy access to the inside for cleaning. They are tested at 150 pounds hydrostatic pressure per square inch. Two sizes of engines are also made of the box-bed plate pattern, but having the same style of boiler as here shown.

The builder of these engines declares that the very best materials and workmanship are employed.

One of the extensive iron shipbuilding firms on the Delaware river has received orders to build nine iron steamers, to be used by the London navigation company on South American rivers. These boats are to be of good size and first-class finish and fittings. The English company consider that they can be built and placed in South America cheaper by the American builders than by British builders, particularly their woodwork and finishing, while the American builders are noted for the excellence of their designs and workmanship for river boats.

There are in Pittsburg and immediate vicinity 75 glass works, 24 of which make tableware, 24 window glass, 8 fruit jars, 9 green and black glass bottles and phials, and chimneys. The factories contain 700 pots, employ some 5,500 people, and turn out product valued at about $6,000,000.

TO MAKE SELF-SHARPENING HORSE-SHOES.—Self-sharpening horse shoes are made by the simple expedient of rolling a steel plate in the center of the iron from which the shoe is made, so that the calks of the shoe have a hard steel center, and as the soft iron wears away by use the sharp steel is left to prevent slipping.

The committee of fifteen citizens chosen in special town meeting some time since in Marlboro, Mass., have voted unanimously to recommend the town to introduce water, at an expense not exceeding $100,000. For the consideration of the matter a special town meeting will be held.

An Iowa woman examined a straw cutter in a hardware store, and she has just recovered $500 damages for the loss of two fingers, on the ground that the machine was not labeled "dangerous."

The directors of the Connecticut River Railroad have passed an order, instructing the superintendent "to summarily dismiss any employe on any train who is known to use intoxicating liquors while on duty, or who is known to have been intoxicated while on duty."

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.

LYCURGUS B. MOORE, Treas.

JACKSON BAILEY, Vice-Prest.

DAVIS STRONG, Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

The American News Company,

Publishers' Agents, New York.

The International News Company,

(Formerly the Willmer & Rogers News Co.)

11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.

Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

DEALERS SUPPLIED BY

The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis Book and News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh Book and News Co., Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Co., Providence, R. I.
The San Francisco News Co., San Francisco, Cal
The Brooklyn News Company, Brooklyn, L. I.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Washington News Co., Washington, D. C.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.00 to Foreign Countries, postage prepaid.

ADVERTISING.

Transient, 30c. per line, (12 lines one inch.)
"Business Specials," 40c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers who fail to receive their paper promptly will please notify us at once.*

☞ Entered at the Post Office at New York, N. Y., as second class mail matter.

NEW YORK, MAY 15, 1880.

CONTENTS.

	PAGE.
Extracts from Chordal's Letters	1
New Style of Air Compressor	2
Balky Locomotives	2
The Standard Sectional Covering	2
Mechanical Confusion. Chas. A. Hague	2
Hints on Lathe Tools. Wm. Main	3
Moral Power of Machinery	
Annealing Steel in Boiling Water	4
Improved Drilling, Slotting and Boring Machines.	4
Electricity Transmitted through Pipes	4
Metal Vessels Lined with Sheet Tin.	4
New Welding Process	4
A New Gatling Gun	4
Work-Holder for Lathes	5
Steel vs. Iron Built Vessels	5
The Narrowest Gauge Railroad	5
Practical Draughting.—T. P. Pemberton	6
New Way of Heating Railway Carriages	6
Mechanic's Lien	6
Letters from Practical Men	6
New Portable Engines	7
Competitive Tests of Machinery	8
Practical Shop Lectures	8
Special International Exhibitions	8
American Machinery in Australia	8
Progress of Co-operation	8
Literary Notes	9
Questions and Answers	9
Manufactures.	9
Machinists' and Engineers' Supplies	10
Iron Review	10
Metal Review	10

Competitive Tests of Machinery.

The extraneous claims often set forth by machinery manufacturers are, by a large portion of the public, accepted as wholly correct, because purchasers have no records of impartial tests to guide them in weighing the claims presented. Where such tests have been made, and the results published, a basis of comparison exists which makes it extremely difficult for a boastful manufacturer to deceive a wary purchaser. But authoritative tests to determine the merits, both relative and absolute, of machinery and appliances are by no means common. The autumn industrial exhibitions scatter gold, silver and bronze medals and diplomas, every year, for real or supposed excellencies in mechanical design and construction, but not one article in fifty is subjected to a practical trial before deciding to make an award. A neat and attractive display of finely finished mechanical objects is often thought worthy of an award, without presenting any further claims. As a consequence the influential value of exhibition premiums has experienced a heavy decline within the last ten years, during which period the number of industrial exhibitions has been steadily on the increase. The public are becoming better acquainted with the conduct of these exhibitions, and estimate the value of honors they dispense in an inverse ratio to their knowledge of the basis upon which the honors are conferred. But there is a marked tendency towards substantial improvement in the methods of determining upon whom to bestow especial awards, where there is competition at industrial exhibitions. Fairly conducted tests are being instituted which leave no doubt as to where the award belongs. The tests of steam fire engines, boilers, and turbine water wheels at the Centennial gave results, the publication of which afforded purchasers specific and reliable data as to the performance of those classes of machinery. They also stimulated a popular demand for other tests of like nature, which is becoming stronger as the claimants for a share of the purchaser's patronage become more numerous.

Next month at the Millers' International Exhibition in Cincinnati, thorough competitive tests of steam engines are to be made and half a dozen of the leading engines have been entered for the contest. The result will be looked for with special interest. Although the rate of speed at which all the engines must be run virtually bars out the highest speed engine from entering the expert test, the regulations seem perfectly satisfactory to all those who have placed their names on the lists. With a little enterprise the managers of autumn industrial exhibitions, both East and West, could make expert tests of machinery a leading and valuable feature of their displays. If properly organized these tests would attract the best class of manufacturers, and excite an interest that would not be lost with the closing of the exhibitions. If medals and diplomas are to be given for mechanical exhibits let them represent superior merits as determined in thorough competitive trials.

Practical Shop Lectures.

The proprietor of a New England machine shop, who is also mechanical superintendent of another good-sized manufacturing establishment, has found a sure preventive for labor troubles among his men. At stated intervals he devotes a convenient hour to a system of shop lectures, illustrated by the blackboard. At an appointed hour the bell strikes and the men gather in a room arranged for the purpose; the superintendent mounts the platform, and delivers a brief discourse in familiar language upon some previously named mechanical subject, about which both himself and the men have had time to think.

In this way an hour is spent pleasantly and profitably by all, as the workmen are privileged to ask any questions about the subject under discussion that may occur to them; and often, through such questioning, the lecturer finds himself brought face to face with a bit of mechanical knowledge, or some valuable deduction, that he had never thought of before. Knowing that the occasional hour thus spent will, by stimulating thought, advance the work of the shop more than if spent in the ordinary routine of labor, the proprietor feels that the pains thus taken will prove a good investment. The men feel that his object is to make them worth more, both to the shop and to themselves, and, with both sides acting upon this view, labor disputes are unnecessary and unknown.

A happy illustration of this occurred recently, which speaks well for the results of this system of familiar shop lectures. During the present season of business activity, some new men had to be hired. Among those offering their services was one so-called "machinist," who wanted $2 per day. He was set to work cutting gears. His first job being completed, another sized gear was wanted, and the new recruit was requested to adjust the machine accordingly. But this Mr. Recruit could not do, his education being wholly limited to machine-feeding, pure and simple. The proprietor called a bright boy, the son of one of his workmen, who was learning to be a *real machinist*, on apprentice wages, and, as a result of the knowledge gained in one of these lectures, the apprentice readily made the required adjustments, much to the confusion of the so-called workman. The latter afterwards attempted to quiz the apprentice about the pay of boys in that shop. "Oh!" said the embryo master of matter, "we get 75c to $1 a day in cash, and anywhere from three to ten times that in knowledge!" Some day that boy will have a shop of his own, though his present surplus capital consists mainly of a clean shirt and a silver dollar.

But the most obvious moral to be drawn from the doings of this capable superintendent of two shops, is this: The busiest men are usually those who contrive to find the most time in which to help their fellows.

Special International Exhibitions.

The organizing of industrial exhibitions for specified kinds of productions is becoming popular both in Europe and America. These exhibitions are usually of an international character, and are well calculated to promote improvements in the particular classes of goods they are designed to represent. Among those now in course of preparation we may mention first the Millers' Exhibition to open in Cincinnati, May 31, and continue two weeks. This is to be held under the auspices of the Millers' National Association, and has, we learn, attracted a good representation from abroad as well as from all parts of the United States. The exhibition of small steam threshing machines in Perugia, Italy, opens July 1, under government auspices. Our manufacturers ought to send machines to this contest that should gain some, if not all, of the prizes. Applications for admission close May 31.

One of the most interesting international exhibitions promises to be that of the earthenware, chalk, cement and gypsum industry to be held at Berlin from June 29th to August 10th. Only such objects can be sent to the exhibition as are directly or indirectly made of *brick, tiles, earthenware*, chalk, cement, or gypsum.

As the state of the ceramic (or keramic) industry is so much more advanced in Europe than in America, it is scarcely to be expected that our manufacturers will enter goods for competition; but if the machinery used in producing brick, artificial stone, etc., were to be admitted, something could be sent from this side of the Atlantic that would give visitors to the display some new ideas.

An international display of sheep wool and wool products is to be held in Philadelphia next September, under the auspices of the Pennsylvania State Agricultural Society. This exhibition is also open to cattle, horses, swine, poultry, and farming implements. Prizes are to be awarded to the extent of $40,000.

An exhibition and market of machinery, implements, and material used or sold by printers, stationers, paper-makers, and kindred traders, is to be held at the Agricultural Hall, London, on Monday, July 5, and five following days, under the patronage of the Lord Mayor.

International exhibitions of scientific instruments, fine arts, and other specialties have, at different times, been held in Europe with abundant success. It is but recently that special exhibitions on a large scale have been undertaken in our own country, for which no geographical limits were fixed, and there is reason to believe they will succeed as well as those held abroad.

American Machinery in Australia.

Since our last issue, Mr. Thomas R. Pickering, heretofore Government Agent for the collection and arrangement of exhibits, has been appointed by Hon. Wm. M. Evarts, Secretary of State, an Executive Commissioner for the United States to the Melbourne Exhibition. Mr. Pickering will leave New York for Melbourne about the 1st of July, and remain during the whole exhibition in personal charge of the United States portion. As noted in our last, the original space for American exhibits has been largely increased. It would doubtless lead to a remunerative and permanent trade with Australia, if a large number of our machinery manufacturers would send exhibits to this Exhibition. It is desirable to send woodworking machinery, agricultural machinery, woolen machinery, mining machinery, railway appliances, blacksmithing tools and machines, tin-working machinery, machinists' tools, engines, boilers, and special machinery. The April 9th issue of one of our English exchanges mentions among the values of exports of machinery from Great Britain, for the week ending April 2, to Melbourne, £365; Adelaide, £599; Brisbane, £120, and Sydney, £2,214. Almost every reliable report received from Australia bears witness that American tools and machinery are there preferred to the English. Competition in prices of the best class of machinery has also ruled in our favor. The Melbourne Exhibition offers the best opportunity our machinery manufacturers will have to introduce their productions to the notice of Australians at very moderate cost.

Progress of Co-operation.

Among the latest developments of co-operation among workmen is the organization of a society in New Jersey called "The Knights of Labor." It is said they are opposed to strikes and are working for the establishment of a co-operative system of labor, by which consumer and producer will be brought into close relations. This object is a worthy one though we hardly see how it can be promoted by such a society. A good number of thrifty workmen, each of whom has saved something from his wages may readily form themselves into a co-operative society to start a shop or factory of their own, but it is necessary that they all be residents of the same locality in order to give their whole attention to the business. It would be a questionable plan, to say the least, for several co-operative establishments in different lines of business and at a distance from each other to be owned in common.

Strikes are always to be deplored but one of the occasional good results of strikes is the founding of co-operative establishments by the strikers.

For example, three new co-operative furniture factories are to be started in Chicago by striking workmen from the same number of old furniture factories. If, instead of lying in idleness and trying to force employers to terms, using up their own savings and perhaps a considerable sum from their fellow-workmen in the trade unions, dissatisfied artisans would unite their "ways and means" in starting business on their own account, they would find themselves in much better circumstances than they would by gaining a strike, and productive industry at large would be benefited instead of suffering a loss. The success of co-operative manufactories seems to compare very favor-

ably with that of incorporated companies. Some fail by reason of bad management, and some have shown extraordinary prosperity. A few, between the two extremes, have gravitated into joint stock corporations, with satisfaction to those holding shares in the original enterprise. Workmen who are skillful, ambitious, frugal and intelligent will do well to start co-operative establishments for productive industry, if they do not join their fortunes with the opposite class.

LITERARY NOTES.

PRACTICAL HINTS ON MILL-BUILDING. By R. James Abernathey. Illustrated 8vo, cloth, 300 pages. $4.00. Published by the author, Moline, Ill.

The object in publishing this book is stated in the preface—viz.: "To place before the milling public a distinctively flour-milling and mill-building work." The volume begins with a very interesting essay, describing how the millwrights used to accomplish their work, giving the necessary qualifications required of them when milling was in its infancy. The apprentice is taught how to lay out, construct, and adjust for running all parts of a mill. Tables and practical rules in simple arithmetic are given, which will enable the millwright to compute the required pitch for developing a given number of horse-powers for spur and bevel iron-teeth wheels. Rules and tables for the horse-power of mortise, spur, and bevel wheels, shafting, pulleys, and belting, are also given. A portion of the book is devoted to useful information, and rules for emergencies, etc. The new processes of making flour, also the different kinds of grinding-machinery, including the roller systems, are explained in a plain manner. We noticed an article on "The Arrangement of Belts," by F. C. Smith, which was taken in full from the columns of THE AMERICAN MACHINIST, giving due credit for the same. The closing retrospection contains some very valuable advice to apprentices and young mechanics. The author has succeeded in producing a very practical book, and deserves the attention of all who are engaged in erecting or running mills.

A TREATISE ON THE RICHARDS STEAM-ENGINE INDICATOR, WITH DIRECTIONS FOR ITS USE. By Chas. T. Porter. Revised, with Notes and Additions; a Supplement and Appendix. By F. W. Bacon, M. E. Third Edition. Pocket size. $1. Published by D. Van Nostrand, New York.

This treatise on the Steam Engine Indicator contains 180 pages, which has passed through two editions, and the third is now issued. The indicator is becoming better understood every year, and has probably been greatly aided by the able articles which have been written on the subject from time to time.

The speed of the steam engine has been greatly increased, the weight of the moving parts has been greatly reduced, and true economy has become better understood by persons who were heretofore disinterested. Since the issue of the first edition of this book there has been great improvements made, not only in working up the diagrams taken by the indicators, but the indicators themselves have been greatly simplified. Instruments such as the planimeter and pantagraph have been introduced, by which cards may be worked up in a very short time. The original book has been reprinted with necessary corrections and alterations; a supplement has also been added which illustrates and describes the instruments referred to, as well as their practical applications. This book is intended principally for practical engineers, who have not had the advantages of a technical education, and it will, no doubt, meet their expectations.

The *American Art Journal* of New York, edited by Wm. M. Thoms, is now seventeen years old, and the largest and finest publication devoted to music, art, literature and the music trades, especially the gossip and news of the musical world, that is published on either side of the water. It is published every Saturday, and contains sixteen pages of well selected reading matter, and gives an astonishing amount of information on all the transactions in the music trades. It publishes each week a portrait of some noted musical celebrity and is full of news. It enters on its eighteenth year full of promise and with the hearty well-wishes of its thousands of patrons and readers.

Business Specials.

40 cts. a line for each insertion under this head.

A New Pulsometer; saves 100 per cent. in coal. Office, 40 John Street, New York. "We have one of your New Pulsometers, which we have used in various places, on sewer and other work, and it has always worked to perfection under all circumstances. I believe it will do all you claim for it, and more too."—C. A. Allen, City Engineer, Worcester, Mass.

American Watch Tool Co., Waltham, Mass., Whitcomb Watch Makers' Lathes, and Watch Machinery.

Improved Work Holder for Lathes, Gear Cutting Attachment for Lathes, Tyson Vase Engine 1-32 Horse Power, New Tools, Chucks, Drills, Lathes. Send for 1880 Catalogue. Jackson & Tyler, Baltimore.

All kinds machine drawings. Inventors' work a specialty. Hours, 9 to 6. Wm. D. Skidmore, No. 733 Broadway, N. Y.

For Schaffer & Budenberg's celebrated Steam Pressure, Hydraulic and Vacuum Gauges, Engine Counters, Pyrometers, Thermometers, Reducing Valves, Superior Crystal Gauge Glasses, etc., address W. Heuermann, 40 John Street, New York.

See Christiana Machine Co.'s adver., next number.

Wilkinson & Crowell, 1201 Beach St., Philadelphia, make an Improved Metallic Piston Rod Packing, which is entirely automatic and of great durability. Works well at high or low pressure, and can be used in common stuffing box, or without any stuffing box at all.

Norris & Rutter, Mechanical Draughtsmen and Patent Solicitors, 424 Walnut Street, Philadelphia.

A new automatic valve gear for steam engines complete. Address, Ed. F. Williams, P. O. Box 148, Leadville, Colorado.

Screw Presses. Stiles & Parker Press Co., Middletown, Ct.

Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, 65 Henry Street, Brooklyn N. Y.

James W. See, Consulting Engineer, Hamilton, Ohio.

Car Builders' Dictionary. Now ready. Assigns names to kinds and parts of railroad cars, identifying each. 800 engravings, and 490 pages. Price, postage prepaid, $2. Ten copies to one address, $17.50. Published by the *Railroad Gazette*, 73 Broadway, New York.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

To Manufacturers and others: We are prepared to build all kinds of machinery. Patent Articles a Specialty. Correspondence Invited. Mather & Newitt, Practical Machinists, Leominster, Mass.

John Fish, M. E. Air Compressors and Working Drawings a specialty. Room 23, 10 Pine St., New York.

MacKensie Patent Cupola and Blower. The best apparatus for melting iron, and with water bosh for smelting lead and silver and copper ores. Send for pamphlet. Smith & Sayre M'f'g Co., 21 Courtlandt Street, New York.

W. Barnet Le Van, Mechanical and Consulting Engineer, 3607 Baring Street, Philadelphia, Pa.

Invaluable to Machinists, Draughtsmen, Pattern Makers, etc. Nickled instrument giving exact circum, of any diameter, or *vice versa*, without prepared scales. Prepaid, $1. L. B. Woodruff, 59 Halsted St, Chicago.

Wanted.—To trade valuable town property for Machinery Iron Works property. Address K, office American Machinist.

Rare opportunity to purchase a complete set of the "Encyclopædia Britannica," 8th edition. Twenty-three books, bound in cloth, at $55. Address, J. F., care American Machinist, 96 Fulton Street, N. Y.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) H. S. R., Union Springs, N. Y., asks: Will you please inform me how salt is extracted from water on steamships, so as to obtain fresh water for the steam-boilers and other purposes where fresh water is needed? *A.*—Fresh water is obtained from salt or sea water by passing it through a surface condenser, in which the tubes are surrounded by steam. The steam thus generated from the sea-water passes into a second condenser, where the tubes are surrounded by water. The steam is by this means condensed into water which is free from all saline matter. Water thus obtained may be used for drinking purposes, but where a supply for steam-boilers alone is required they should first be filled with fresh water, after which may be replenished by sea-water. The water of condensation is returned to the boiler, passing through a properly constructed surface condenser, and is used over and over again. Water from the engine condenser is not used for drinking purposes, as no process has yet been introduced whereby the oil and strong greasy taste (received in passing through the engine) can be removed. The process is simply converting sea-water into steam and condensing the steam, leaving the salt, as a precipitate, in the boiler.

(2) A. D., Port Chester, N. Y., asks: What bells do the pilots strike to signal the engineer to start, stop or reverse, and so on, on board Sound steamers and propellers? *A.*—One stroke of the large gong, or one pull of the "jingle bell," signifies all right, go a-head. One stroke of the gong (if the engine is in motion) is a signal to stop. If the engine be at rest, two strokes of the gong is a signal to back. If the engine be running a-head, three strokes of the gong is a signal to reverse the engine. If the engine be running a-head, one pull of the jingle bell is a signal to run faster. These are the principal signals, but different or additional signals are sometimes used on different lines of boats. 2. Where do engineers on same boats apply and get licenses to run them, and what is the cost of same? *A.*—All applications for licenses for positions as marine engineers must be made to the Government Inspector of Steam Vessels, Post Office Building, New York, who will inform you in regard to the proper course to pursue in order to obtain the same.

(3) G. C. W., Stuart, Iowa, asks: 1. In your issue of January 17th, 1880, No. 3, Mr. Chordal mentions several ways that a person could take to bore a taper hole (as, for instance, a taper hole for a cock, of which he speaks), and one of the many ways referred to is to tie a cord to the handle of the screw of the cross-feed, the other end to any convenient place. Now I contend that that way will not bore a straight taper, and he may not for aught I know. But from the way he wrote I supposed he did, and this is what I want to know—*i. e.*, whether it will or will not. I think it will bore the hole, hollowing in the middle, owing to the different positions of the crank. *A.*—You have evidently taken the wrong meaning from *Chordal's* statement, or he did not say just what he meant, as simply attaching a cord to the handle of the lathe would give only a limited and irregular motion. A similar and effective continuous motion may be produced by placing a pulley or drum upon the end of the cross-feed screw. One end of a stout cord should be fastened to the pulley referred to, and a portion of the cord wound upon it, while the other end may be attached to any suitable part of the lathe. By throwing the feed-motion of the lathe into gear and drawing the cord tight, a taper hole may be bored. If the work be particular, a small chain should be used in place of the cord, as the cord is more liable to stretch. 2. Is there a rule for allowing shrinkage on steel tires for locomotive driving-wheels? *A.*—A safe and practical rule for shrinking tires on locomotive driving-wheels is to allow 1-100 of an inch for every foot of diameter—as, for instance, a tire 5 feet in diameter requires 5-100 or 1-20 of an inch for shrinkage.

(4) M. F., Elgin, Ill., writes: I am twenty-five years old, have been in the machinist business for eight years, and I am making tools now at $3.25 per day. I also worked on steam-engine work, and like it better than tool-making, but cannot get as much wages. I like to handle engines and boilers better than anything else. What would you advise me to do—drop the tool-making and go into a steam-engine works at smaller wages, or keep on at tool-making? *A.*—We would advise you to carefully consider your position, and ascertain what benefit, if any, is to be derived from a change of occupation. If it proves to be only a matter of taste, we advise you to stay where you are; but if it proves a matter of adaptation, we advise you to change. We are persuaded, however, that you are well adapted to your present business, judging from your pay. Tool-making, doubtless, pays better than building or running steam-engines. It is also cleaner, and there is less risk of life and limb. Unless you can see your way beyond the position of a mere engineer or machinist, we are persuaded that you better remain where you are, and in the meantime avail yourself of all the literature which you can obtain that will advance you in knowledge of your business. We also refer you to answer to W. A. B., contained in our issue of Nov. 15, 1879.

(5) A. G. T., Bloomfield, N. J., asks: Will you please tell me the number of miles that car wheels will run on an average, or about how long they last? *A.*—The average mileage of cast-iron chilled car-wheels is much greater than it used to be, as there is greater competition in the manufacture. Some of the best manufacturers will guarantee their wheels to run 60,000 miles, while others guarantee 50,000 miles. We believe that a fair average of the best wheels would be 40,000 miles. A new wheel, made of paper and having a steel tire, which has been tested for the past few years, is guaranteed to run 350,000 miles; some of these, however, have run over 700,000 miles, and the intention is to make them run 1,000,000. The chilled cast-iron wheels made in some of the railroad repair-shops will not run over 20,000 to 25,000 miles because of the poor material used, and some of them will break after a few days' service.

(6) G. B. B., Fitchburg, Mass., asks: Which number of the AMERICAN MACHINIST contains a description of a tool for drilling a square hole? *A.*—The information desired was never published in the AMERICAN MACHINIST. The idea is not new, and this novel piece of work was accomplished some years ago by Julius Hall, of London.

MANUFACTURES.

The proprietors of the Reading Hardware Company are negotiating for the purchase of a large tract of land at Robesonia, on the line of the Lebanon Valley Railroad, between Reading and Harrisburg, Pa. They propose to remove their entire works to that point, and to build homes for workmen, and in this way to shield themselves from the injuries of strikes. They employ three hundred men at present.

The Pacific Iron Works of San Francisco have just begun to build the Wheelock Steam Engine, the invention of Jerome Wheelock of Worcester. Parties in Manchester, England, and Lisle, France, are also building the Wheelock Engine.

Ground has been broken at Angora, Pa., for a new brick cotton mill to run 30,000 spindles.

The Holyoke Paper Company, Holyoke, Mass., has granted an increase of pay to the loftsmen and engineers in their mill. The engineers receive an additional twenty-five cents per day.

Mr. Charles W. Copeland, one of the oldest and best known constructing and consulting engineers in this country, has removed his office from 64 Broadway to 24 Park Place and 19 Barclay Street, New York.

The Pocassat Manufacturing Co., of Fall River, Mass., are putting in the foundation for a new machine shop.

The American Tube and Iron Company at Marietta, O., is about to begin work.

A new rolling mill is soon to be erected at Logan, O.

Sterling & Jessop, of Pocasset, Mass., are about to erect another building for store room and carpenter and machine shop, to be 180 feet long and two stories high.

A new firm has purchased the boiler works formerly operated by Bollman, Kilgore & Co., situated at Sharpsburg, Pa., and will start them in a short time. The works have been idle nearly three years.

The Miller Co., Canton, O., has lately been organized with $10,000 capital to build the Torrent steam pump.

As a result of the Chicago strike, three new manufactories of parlor frames will soon be in operation in that city. These factories will be run on the co-operative plan.

The Winona Paper Co., Holyoke, Mass., has filed its articles of incorporation at Boston. The capital stock of the company is $60,000.

The Clayton Steam Pump and Air Compressor Works, Brooklyn, N. Y., enlarged their shop 50 per cent. within the past six months, yet have been obliged to employ another shop exclusively on air compressors for mining purposes.

The Powell Tool Company, Cleveland O., are so pressed with business as to compel an increase of their works, and they are therefore building an addition of fifty feet with ten more forges, which will be in operation in about thirty days.

The Ætna Mills at Watertown, Mass., are building a three-story brick addition 120×53 feet. The wages of the operatives has been increased 10 per cent. recently, and by the voluntary action of the owners.

The workmen of the London, Ont., Machine Screw Company have struck for an advance of 35 cents per day.

The iron moulders of Chicago are engaged in a quiet movement for an increase of wages at the rate of 25 cents a day, and fixed hours of labor. Their pay now ranges from $1.25 to $3 per day.

The fifteen car manufacturing establishments of the United States turned out last year 37,350 pieces of rolling stock.

The Board of Public Works of Akron, O., has decided to increase the wages of its laborers to $1.25 per day.

Machinists' and Engineers' Supplies.

NEW YORK, April 29, 1880.

We cannot report any particular change in the supply market this week. Things are quiet and dealers as well as buyers are waiting for something to turn up. In the meantime iron continues to decline.

We are informed that the copper manufacturers have held a meeting and have agreed upon a general reduction of 3 cents per pound on list prices. Planished and sheet copper, having previously fallen 2 cents per pound, will be reduced 1 cent per pound by this agreeement, which takes effect today.

There is a rumored reduction of the prices of heavy hammers and sledges, but it is confined to individuals. There is no general reduction.

Messrs. Sweetland & Co. of 126 Union Street, New Haven, Conn., send us the following net price list of the Sweetland Combination Chuck.

3 JAWS.				4 JAWS.			
4	Inch Chuck		$18.00	6	Inch Chuck		$25.00
6	"	"	20.00	9	"	"	34.00
9	"	"	27.00	12	"	"	46.00
12	"	"	35.00	15	"	"	52.00
15	"	"	42.00	18	"	"	60.00
18	"	"	50.00	21	"	"	76.00
21	"	"	64.00	24	"	"	82 00
24	"	"	80.00	30	"	"	158.00
30	"	"	128 00	36	"	"	210.00
36	"	"	185.00				

Iron Review.

NEW YORK, April 29, 1880.

The pig iron market remains very dull, buyers seeming to have no confidence in the stability of prices. It is probable that iron will go still lower, but will recover again to something near its present price. The increased cost of making iron leaves but little profit to the manufacturer at present quotations: viz., $28 to $30 for No. 1, with $1 less for each lower grade.

Manufactured iron shows no change since our last. Prices are firmer than those of pig iron.

Pierson & Co., 24 Broadway, N. Y., under date of April 29th, 1880, quote prices out of store as follows:

Iron Rails, $68 to $70, according to weight; Fish Plates, 3½c. per lb.; Railway Spikes, 4½c.; Bolts and Nuts, 5c.; Common Bar Iron nominal, 3 5-10c., basis from store; Refined do., 4c., basis; Ulster, 4 2-10 c., basis; Machinery Steel, 7c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 7c.; Sheet Iron, 4¼c., basis; Angle Iron. 4 3-10c.; Tee Iron, 4 8-10c; Band Iron, 4 7-10c.; Hoop Iron, 4 8-10c., and up according to size; Horse Shoe Iron, 4½c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers, 10% off in bulk.

Carmichael & Emmens, 130 Cedar Street, New York, quote prices of Boiler Makers Supplies as follows: Flange, 5¼c. to 5¾c. C. H. Shell, 4c. to 4¼c.; Tank, 3½c. Boiler tubes, 35% to 40% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of April 29, 1880:

The metal market is as much disturbed and unsettled abroad, as in this country. Quotations therefore are merely nominal. The jobbing trade seems to be gradually improving in our home market, and with a stoppage of importations, will right itself. London quotes Straits Tin, about £79 10s.; Singapore, $25.75. Would quote Banca Tin at 23c.; Malacca & Straits 18¼c. to 19c.; Billiton, Australian and Refined, English, 18c. to 18½c. as to quantity; "Lamb & Flag," 18¾c.; Pig Lead, dull and not strong at 5½c. to 5¾c. as to lots; Antimony, 23c., Cookson 18¼c. to 19c.; Other brands; Spelter, 6¼c. (large lots) either Domestic or Foreign; Ingot Copper, 21c. to 21½c.; Nickel, $1.25; No. 1. Solder, 11c. "Half-and-half," 13c.

WANTED.

Wanted—Ten first-class moulders. Address Holyoke Machine Co., Holyoke, Mass.

Machinists Wanted.—Address, Watertown Steam Engine Co., Watertown, New York.

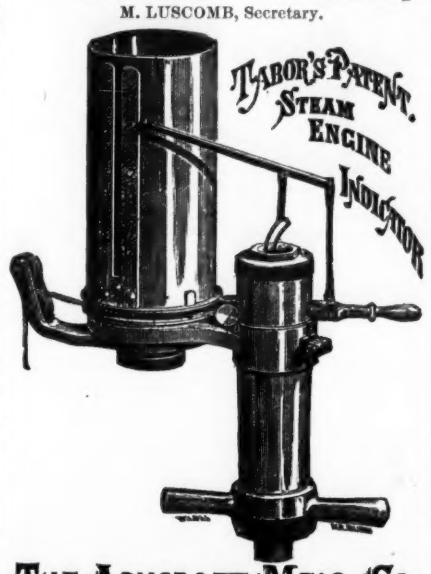
Wanted.—A traveling salesman familiar with steam machinery. Kelly & Ludwig, 720 Filbert St., Phila. Pa.

Mechanical Draughtsman Wanted in the interior of Pennsylvania, as assistant in office. Address, stating salary expected, Alpha, P. O. Box 262, N. Y.

MACHINE
DRAWING COPIES
TEN CENTS EACH.
Send for List of Plates, now ready, and Catalogue of Books for Practical Engineers.
E. & F. N. Spon, 446 Broome St., N. Y.

The only perfect Engine Governor in the World. Especially guaranteed to accurately govern variable cut-off Engines. Send for Circular and REDUCED Price-List.
The Allen Governor Co.
B. W. Spence, Treas. BOSTON, MASS.

E. H. ASHCROFT, Pres. and Treas. CHAS. A. MOORE, Gen'l Manager.
M. LUSCOMB, Secretary.



THE ASHCROFT MF'G CO.
BOLE MANUFACTURERS
BOSTON, MASS.
Also Manufacture
Steam & Vacuum Gauges.
General Railroad, Steamship and Machinists' Supplies.
CAUTION.—As we are in no way connected or interested with any other Steam Gauge Manufacturer, parties ordering goods should be particular and address. THE ASHCROFT MANUFACTURING CO., 51 and 53 Sudbury Street, Boston, Mass.

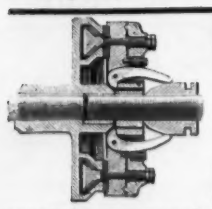
H. S. MANNING & CO.
AGENTS FOR
THE H. B. SMITH MACHINE CO'S
MANUFACTURE OF ALL KINDS OF
Wood Working Machinery,
ALSO,
Engine Lathes and Iron Planers,
CHILLED BEAM VISES,
WITH AND WITHOUT QUICK RETURN MOTION.
111 Liberty Street, New York.

THE ECONOMIZER ENGINE
Comprises Efficiency, Durability and Economy. Has more improvements than any engine in the market. Send for Catalogue.
S. L. HOLT & CO.,
67 Sudbury St., Boston, Mass.

Engine Lathes and Planers.
Lathes from 13 to 20 in. swing. Iron Planers, 24 in. x 6 ft. These are all NEW TOOLS with LATEST IMPROVEMENTS built to our order at the very best New England shops. Send for prices, &c., to
HILL, CLARKE & CO.
36 & 38 Oliver St., Boston, Mass.

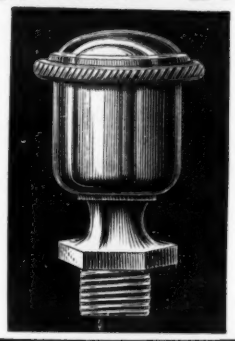
Mechanical Books.
Send 10 cents for 96 page Catalogue of Books for Machinists and Engineers.
D. VAN NOSTRAND,
23 Murray & 27 Warren Sts., New York.

AMERICAN JOURNAL OF INDUSTRY
Most widely circulated industrial journal in the Union. Try it three months, only $1.00. Advertisements and illustrations published at remunerative rates.
JOURNAL OF INDUSTRY CO., Pittsburg, Pa.



Hoisting Engines & Elevators Safe, Durable and Reasonable in Price.
Friction Clutch Pulleys and Cut-off Couplings.
We manufacture the "Giant Friction Clutch Pulley," known as the "Captain." Is the **Best in the World** for connecting the gearing of callender rolls, hoisting coal, logs or freight. Our Clutch can connect any amount of power, at any speed, without slacking the motive power in the least, and gives no shock, is easy to ship and unship, in *fact*, this is the only Clutch that can do heavy work satisfactorily. D. FRISBIE & CO., New Haven, Conn.

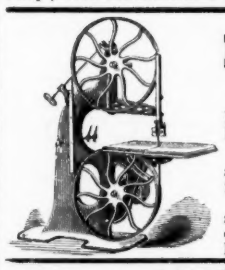
JAMES D. FOOT,



78 Chambers St., NEW YORK.
COMPOSITION METAL
OIL CUP.
PRICE,
$1.50 per dozen.
Subject to discount in quantity.
Samples by mail at 30c. a pair.

FOR SALE.
A Works completely equipped for the manufacturing of carriage axles; is well located in relation to Coal and Iron. also very accessible to market. Address
E. P. BULLARD,
14 Dey Street, New York.

Drawing Instruments
AND MATERIAL, PAPER, &C.
G. S. WOOLMAN,
116 Fulton Street, New York.
Fully priced and illustrated Catalogues.



THE
Rollstone Machine Co.
FITCHBURG, MASS.
Rotary and Stationary Bed Planers, Wardwell's Patent Saw Benches,
Waymouth Lathes,
and large number of special machines.
We also carry a large stock of Second-Hand Machinery. Send for Catalogue.

CHAS. G. LUNDELL,
No. 7 Exchange Place,
BOSTON,
MASS.
REPRESENTING
SWEDISH IRON
EKMAN & CO.
GOTHENBURG,
SWEDEN.

Dead Stroke
POWER HAMMERS
Are superior to all others for Forging and Die Work. Over 500 now in use.
Manufactured by
PHILIP S. JUSTICE,
14 N. 5th St., Philadelphia, Pa.

SAMUEL RAYMOND & CO.
MANUFACTURERS OF
STANDARD SECTIONAL AIR SPACE
PIPE AND BOILER COVERING.

Patented January and April 1870, and September, 1877.
Factory, 642 West 52d Street.
Office, 108 Liberty St., New York.
We claim a larger percentage of saving in condensation than any other covering; greater rapidity and cheapness of application; greater durability, and a neater and better finish when completed. It is especially adapted for shipment to the country. This covering can be easily removed and replaced in case of change in the pipes or for inspection of boilers and used over again. Hair Felt, Plastic and Cement Coverings of the best quality. **Covering of outdoor and underground Pipe a Specialty.**
☞ Send for Circulars.

PATENT NICKEL-SEATED
"POP" SAFETY VALVES
FOR
STATIONARY, LOCOMOTIVE, MARINE and PORTABLE
STEAM BOILERS.

Our Patents cover all Safety Valves utilizing the recoil action of steam, and familiarly known as "Pop Safety Valve."
☞ Purchasers, beware of infringements of our Patents.
Capital, $100,000.
The Consolidated Safety Valve Co.,
Office and Manufactory,
51 & 53 SUDBURY ST., BOSTON, Mass.

WHITTIER MACHINE CO.
MANUFACTURERS OF
STEEL BOILERS,
Steam Engines and Elevators,
Boston, Mass.: Works, 1176 Tremont St.
N. Y. Office, 120 Broadway.

Machinery for Sale,
Three Large Lathes; also, One Large Planer.
FOR PARTICULARS, ADDRESS
The Hartford Fdy. and Mach. Co.
HARTFORD, CONN.
J. S. HUNTER, Prest.

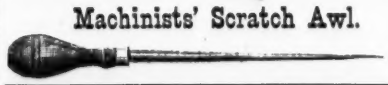
WILEY & RUSSELL MF'G CO.
GREENFIELD, MASS.
Lightning Screw Cutting Machinery and Tools.

SEND FOR ILLUSTRATED PRICE LIST.

JAMES D. FOOT
78 Chambers Street, New York.
Machinists' Surface Gauge.

Height, 8 inches. Arm will scratch 8 inches and 13 inches high. Nickel Plated and a first-class tool.
Price, $2.00.
Description of Machinists' Marking Gauge and Scratch Awl, combined—The Arm is made hollow, holding the Awl which screws in at the end. The Awl is made of Stubs' Steel.
Price, 75 Cents.
Description of Machinists' Scratch Awl.—Length, 6½ inches. Made from Stubs' Steel. Rosewood Handle. Nickel Plated Ferrule.
Price, 25 Cents.
All tools warranted. Prices stated include postage. Send stamp for Catalogue.
Machinists' Marking Gauge and Scratch Awl Combined.

Machinists' Scratch Awl.



RICHARD DUDGEON,
24 Columbia Street.
NEW YORK,
Maker and Patentee of
IMPROVED HYDRAULIC JACKS,

Punches, and Roller Tube Expanders,
AND
DIRECT ACTING
Steam Hammers.
Communications by letter will receive prompt attention.
Jacks for Pressing on Car Wheels or Crank Pins made to order.

NICHOLSON FILE CO.

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS and SPECIALTIES.

"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files.
"Slim" Saw Files.
"Racer" Horse Rasps.
Handled Rifflers.
Machinists' Scrapers.
File Brushes, File Cards.
Surface File Holders.
Vice File Holders.
Stub Files and Holders.
Improved Butchers' Steels.

Manufactory and Offices at **PROVIDENCE, R. I., U. S. A.**

NEWARK STEEL WORKS.

BENJAMIN ATHA & CO.

MANUFACTURERS OF

CAST STEEL

WE MAKE GRADES OF STEEL SPECIALLY ADAPTED TO THE MANUFACTURE OF LATHE TOOLS, CHISELS, TAPS & DIES

BENJ. ATHA. NEWARK, NEW JERSEY. J. ILLINGWORTH.

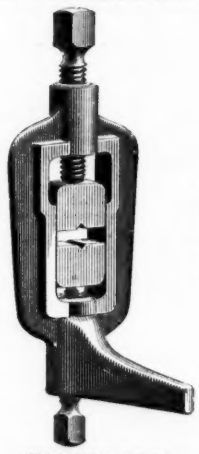
C. W. LeCOUNT,

SOUTH NORWALK, CONNECTICUT,

Manufacturer of

LeCount's Die Dogs,

Have a Steel Frame, with two screws, so as to throw the center of Die the same distance from tail of Dog on a small piece as on a large. The Dies are hardened, and a good job with Hardened Steel Screws. Extra Dies can easily be fitted to suit any special work, or will be furnished as below:



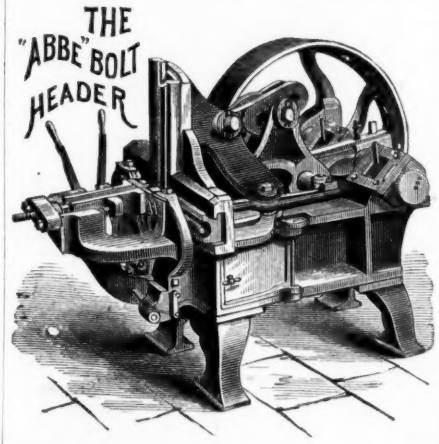
PRICES.

	EXTRA DIES.	OPENS.
No. 1,.....	$1.25	⅜ Inch.
" 2,.....	1.60	¾ "
" 3,.....	2.00	1 "
" 0, Amateurs or for f't lathes	1.25	¾ "

When ordering Extra Dies please state which you require, the V or Tongued.

SED FOR DESCRIPTIVE CIRCUALAR.

BOLT FORGING MACHINES.



Power Hammers, Machinists', Blacksmiths' Tools and Wood-Working Machinery a Specialty.

S. C. FORSAITH & CO.,

MANCHESTER, N. H.

BLAKE'S PATENT STEAM PUMPS.

ADDRESS

GEO. F. BLAKE MANUF'G CO.

44 Washington Street, BOSTON, MASS.

86 Liberty Street, NEW YORK.

SEND FOR ILLUSTRATED CATALOGUE.

SWEETLAND & COMPANY,

No. 126 UNION ST., NEW HAVEN, CONN.

Sole Manufacturers of

THE SWEETLAND CHUCK,

Independent, Universal and Eccentric Combination.

PRICE LIST FURNISHED ON APPLICATION.

POOLE & HUNT, BALTIMORE.

MANUFACTURERS OF

THE POOLE & HUNT LEFFEL TURBINE

WATER WHEELS,

MACHINE MOULDED MILL GEARING,

SHAFTING, PULLEYS AND HANGERS,

STEAM ENGINES AND BOILERS,

MIXERS FOR FERTILIZERS AND CHEMICALS.

S. & C. WARDLOW,

SHEFFIELD, ENGLAND,

SOLE MAKERS OF THE SPECIAL BRAND

TOUGH

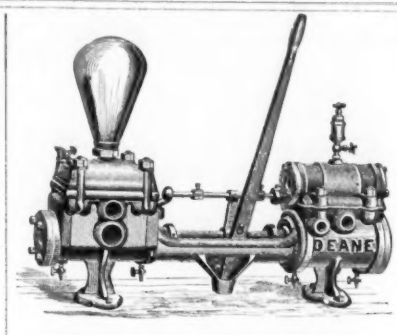
CAST STEEL,

For Turning and other Tools,

ALSO DIES, ETC.

Branch Office & Stores: 95 John St., New York.

WILLIAM BROWN, Sole Agent.



SIMPLE! POSITIVE! DURABLE!

For Every Possible Duty.

The Best STEAM PUMP in America.

"The Deane."

SEND FOR ILLUSTRATED CATALOGUE AND PRICE LIST.

DEANE STEAM PUMP CO.

OFFICE AND WORKS:

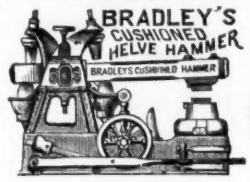
HOLYOKE, MASS.

WAREHOUSE:

92 and 94 LIBERTY ST.,

NEW YORK CITY.

J. H. HARRIS, Manager.



BRADLEY'S CUSHIONED HELVE HAMMER.

Awarded first premium, Silver Medal at American Institute Fair, 1873, Cincinnati Industrial Exposition, 1874, and the Diploma of Honor and Grand Medal of Merit at the Centennial Exhibition, in 1876,

Being the highest award given any goods of their class in America or Europe.

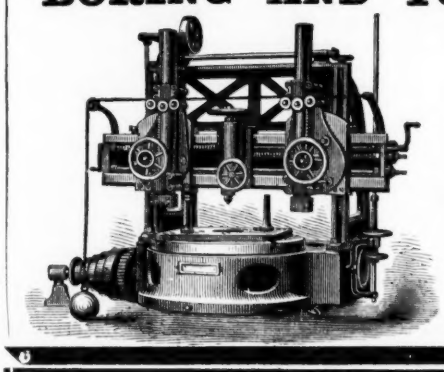
IT HAS MORE GOOD POINTS, LESS COMPLICATION,
MORE ADAPTABILITY, LARGER CAPACITY,
DOES MORE AND BETTER WORK, TAKES LESS POWER,
COSTS LESS FOR REPAIRS

THAN ANY HAMMER IN THE WORLD.

Guaranteed as represented. (Established 1832.)

BRANCH OFFICE, 24 & 26 So. Canal Street, CHICAGO, ILL. **BRADLEY & COMPANY, Syracuse, N. Y.**

BORING AND TURNING MILLS.



All Sizes: 4, 5, 6, 8, 10, and 12 feet Swings.

PATENTED IMPROVEMENTS.

New Patterns.

MACHINISTS' TOOLS,

The Latest and Best, at very moderate prices.

NILES TOOL WORKS, HAMILTON, OHIO.

HALL'S PATENT

DOUBLE COMPOUND LEVER CUTTING NIPPERS.

MACHINISTS'

SUPPLIES.

Price $1.25.

Sent by mail for 6 cents additional.

Every pair warranted.

Of the many Cutting Nippers heretofore placed on the market, not one has supplied either of the two great needs long felt by all who use them, viz.: 1st. Increased power without a clumsy and expensive increase of size. 2d. That the construction of the Nipper should be such that any damage to the cutting jaw or handle, from wear or accident, could be repaired.

All orders should be addressed to

PETER A. FRASSE & CO., Sole Agents, 95 Fulton Street, New York.

STEEL CASTINGS

FROM 1-4 TO 10,000 LBS. WEIGHT.

True to pattern, sound and solid, of unequaled strength, toughness and durability. An invaluable substitute for forgings or cast iron requiring three-fold strength.

Gearing of all kinds, Shoes, Dies, Hammerheads, Crossheads for Locomotives, etc. 15,000 Crank Shafts, and 10,000 Gear Wheels of this Steel now running prove its superiority over all other Steel Castings.

CRANK SHAFTS, CROSSHEADS and GEARING Specialties.

Circulars and Price Lists free. Address

CHESTER STEEL CASTINGS CO.

Formerly McHaffie Direct Steel Castings Co.

Works, CHESTER, Pa. 407 Library St., PHILADELPHIA.

TRADE MARK.

The Workshop Companion.

A handy and useful dictionary of practical information for **Engineers, Machinists, Draughtsmen and Mechanics**, containing useful and reliable recipes, rules, processes, methods, practical hints, &c. **NO** medical or cookery recipes. 164 pages. This book will be sent, post-paid, on receipt of Twelve 3-cent postage stamps.

T. P. PEMBERTON,

249 Duffield St., Brooklyn, N. Y.

F. W. MOSS,

80 John Street, New York,

(Successor to Joshua Moss and Gamble Bros.,)

Steel and Files,

HAMMERS, ANVILS, VISES AND BLACKSMITHS' TOOLS.

WARRANTED CAST STEEL,

Specially adapted for Dies, Punches, Turning Tools, Drills, &c. Also

IMPROVED MILD-CENTRED CAST STEEL

For Taps, Reamers, Milling Tools, &c.

Warranted not to crack in hardening Tools of any Size.

Steam Pumps,

AIR COMPRESSORS,

Friction Hoisting Engines,

Vacuum Pumps & Condensers,

GENERAL MACHINERY,

Steam Engines.

Capacity to bore Cylinders 110 Inches Diameter, and turn Fly Wheels of 24 feet.

THE NORWALK IRON WORKS CO.

South Norwalk, Conn.

Address P. O. Box 2187. **PIERSON & CO.** Office, 24 Broadway, N. Y.

ESTABLISHED 1790.

IMPORTERS AND DEALERS IN

IRON and STEEL of every Description.

Warehouse, 24 & 26 Broadway, and 77 & 79 New Street.

PRICE LISTS FURNISHED ON APPLICATION.

P. BLAISDELL & CO.,

MANUFACTURERS

MACHINISTS' TOOLS,

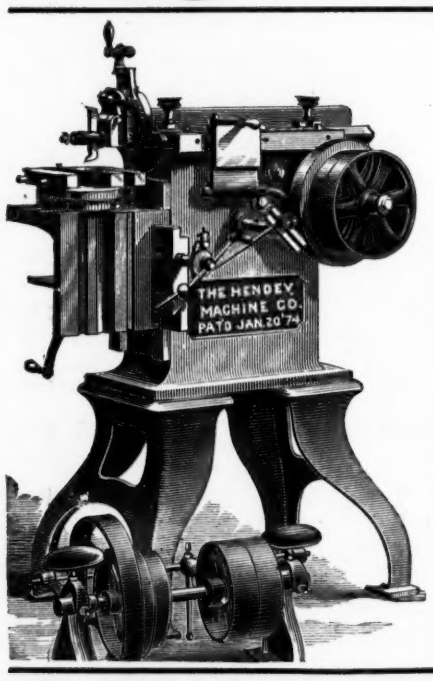
Blaisdell's Patent Upright Drills

With Quick Return Motion.

Engine Lathes, Planers, Boring Mills, Gear Cutters and Hand Lathes.

WORCESTER, MASS.

Please state where you saw this Advertisement.



The Hendey Machine Co.

Wolcottville, Conn., U. S. A.

MANUFACTURERS OF THE

MANVILLE PATENT IRON

Planers and Shapers.

24 in. Shapers, 15 in. Shapers, 5 ft. x 24 in. Planers, 3½ ft x 16 in. Planers, 24 in. Amateur's Hand Planers, with Chuck and Centers, 3 ft. x 8 in. Fine Engine Lathes, 5 ft. x 12 in Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck and Common Clock Lathes.

☞ Send for Catalogue giving description of Tools, with names and opinions of users, and mention where you saw this.

SAMUEL A. BECKETT, Mechanical Engineer. FREDERICK H. McDOWELL, Engineer of Mines.

Beckett & McDowell,

Formerly with Union Iron Works (PRESCOTT, SCOTT & CO.) of San Francisco, Cal.

MINING AND MECHANICAL ENGINEERS

AND MANUFACTURERS OF

Steam Engines and Mining Machinery,

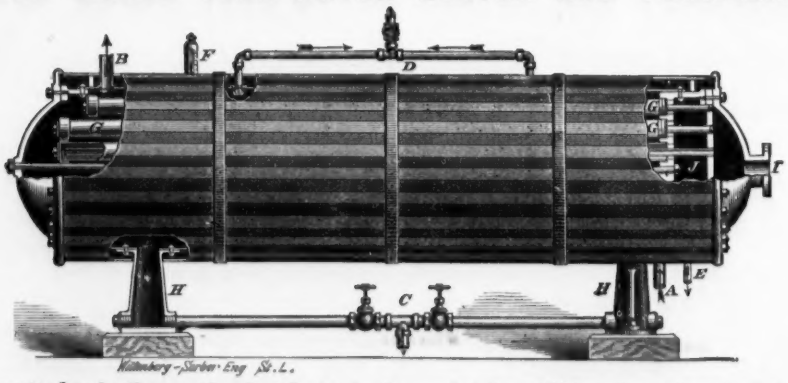
Office, 17 COURTLANDT ST., NEW YORK.

Works at Arlington, N. J.

PUBLISHERS' NOTICE.

The increasing pressure of advertisements upon our strictly limited space has crowded out our own column announcement. Drop a postal for circular containing selected list of "Practical Articles" by **Fifty-Five** of the best mechanical writers in this country, which have been contributed to the AMERICAN MACHINIST from time to time. **AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.**

THE MORSE FEED-WATER HEATER AND PURIFIER.



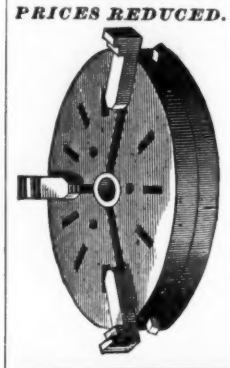
Guaranteed to be the most perfect device in the market for utilizing the exhaust of steam engines. For further particulars, address

E. L. MORSE, Mechanical Engineer, 313 Olive Street, St. Louis, Mo., or J. F. WANGLER, St. Louis Boiler Works.

The E. HORTON & SON CO.

WINDSOR LOCKS, CONN.

PRICES REDUCED.



MANUFACTURERS OF

THE HORTON LATHE CHUCK

BOTH

INDEPENDENT AND UNIVERSAL,

ALSO THE

Horton Car Wheel Chuck.

FEBRUARY 1st, 1880.

From this date a discount of 25 per cent. will be made from the list price of The Horton Lathe Chuck,

Soliciting your orders, we are, respectfully yours,

Send for Price List. **THE E. HORTON & SON CO.**

H. PRENTISS AND COMPANY

Manufacturers of PATENT RELIEVED

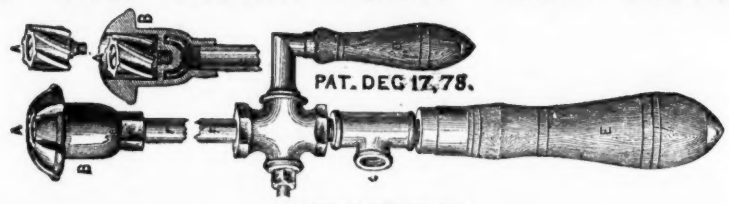
Machinists', Blacksmiths' and Gas Fitters'

Taps; Dies, Reamers and Screw Plates, &c., &c.

DEALERS IN MACHINISTS' SUPPLIES.

No. 14 DEY STREET, - NEW YORK.

The New Steam Boiler Tube Cleaner,



MANUFACTURED BY

WILLIAM COOKE, 6 Courtlandt St., New York,

Is the simplest, and most effective and economical machine made. Send for Descriptive Circular.

Betts Machine Co.

WILMINGTON, DEL.

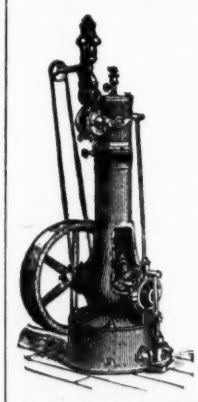
Makers of

HEAVY MACHINISTS' TOOLS

of the various kinds for working Iron and Steel; Standard Gauges, Measuring Machines, &c., &c.

Send for Circulars and list of tools on hand for immediate delivery.

Vertical and Yacht Engines.



The Rowland

Vertical Engine.

LARGE WEARING SURFACES.

Simple in Construction.

JAMES BEGGS & CO.

New York Agents.

8 DEY STREET,

NEW YORK.

F. C. & A. E. ROWLAND, Engineers,

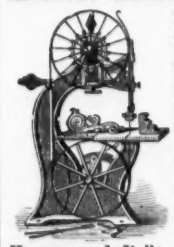
NEW HAVEN, CONNECTICUT.

WOOD WORKING MACHINERY

J. A. FAY & CO.,

BUILDERS OF

IMPROVED MACHINERY FOR WOOD CUTTING.



Numbering some 300 different Machines—Planing and Matching Machines, Surface Planing Machines, Molding and Tenoning Machines, Mortising and Boring Machines, Carving and Dovetailing Machines, Shafting and Friezing Machines, Horizontal and Vertical Boring Machines.

Improved Variety & Universal WOOD WORKERS.

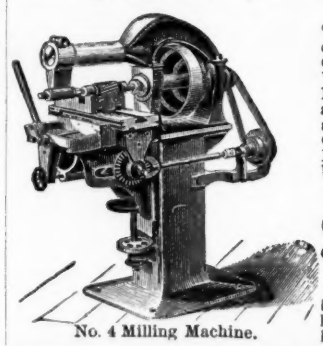
Band, Scroll, Ripping and Cutting-off Saws, Band and Circular Resawing Machines, Spoke and Wheel Machinery, Shafting, Hangers and Pulleys, etc., etc. Original in design, simple in construction, perfect in workmanship, saves labor, economizes lumber, and its productions are of the highest standard of excellence. *Send for Circulars and Prices.*

J. A. FAY & CO., Cincinnati, Ohio, U.S.A.

E. E. GARVIN & CO.

Manufacturers of

Milling Machines, Drill Presses,



No. 4 Milling Machine.

Hand Lathes, Tapping Machines, Cutter Grinders and Wood Planers. Milling Cutters, all shapes and sizes. Gear Cutting and Milling in all its branches.

139-143

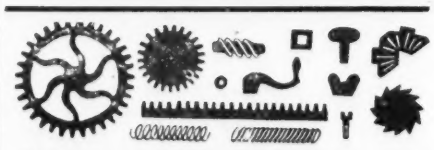
CENTRE ST.

Cornell's B'ld'g

NEW YORK.

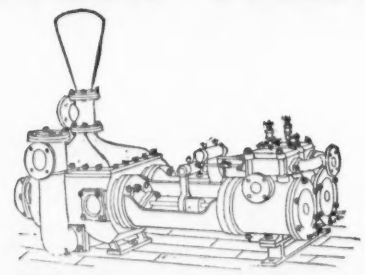
☞ Send for illustrated Catalogue.

AITCHISON & DOOLITTLE, SOLE MANUFACTS OF
STEAM FLUE CLEANER
CLEVELAND, O.
PAT JULY 15, 79
A & B SECTION VIEW
CIRCULARS ON APPLICATION
WOOD & DRAKE 71 RUTGERS ST. N.Y.
ACTS FOR NY & N J



Small Tools of all kinds: GEAR WHEELS, parts of MODELS, and materials of all kinds. Catalogues free. GOODNOW & WIGHTMAN, 176 Washington St., Boston, Mass.

STEAM PUMPS.



HENRY R. WORTHINGTON,

239 Broadway, N. Y. 709 Market street, St. Louis,
83 Water street, Boston.

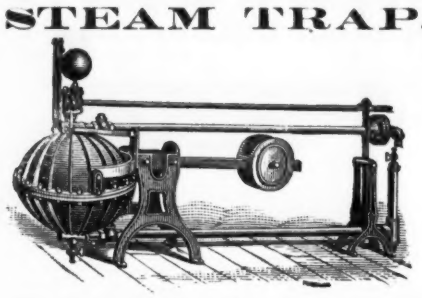
THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water Works Stations.

Worthington Steam Pumps of all Sizes and for all purposes.

PRICES BELOW THOSE OF ANY OTHER STEAM PUMP IN THE MARKET.

WATER METERS. OIL METERS.

THE ALBANY STEAM TRAP.



This Trap automatically drains the water of condensation from HEATING COILS, and returns the same to the Boiler, whether the coils are *above or below* the water level in Boiler, thus doing away with pumps and other mechanical devices for such purposes.

Apply to

Albany Steam Trap Co.

ALBANY, N. Y.

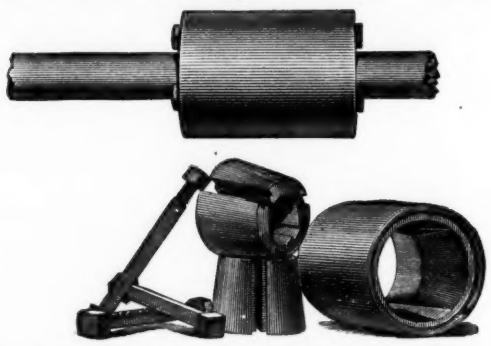
ESTABLISHED 1848.

WILLIAM SELLERS & CO.

PHILADELPHIA.

Machine & Railway Shop Equipments

Shafts, Couplings, Hangers, Pulleys, Mill Gearing, Etc.



Lathes, Planers, Drills, Shapers. Bolt Cutters, Etc.

Railway Turntables & Pivot Bridges. Gifford Injectors, Sellers' Improvements.

NEW PATTERNS. SIMPLE, EFFECTIVE.

New York Office, 79 Liberty Street.

THOS. PROSSER & SON,
15 Gold St., NEW YORK.

"Prosser" Boiler Tube Expanders,

STEEL SCREW PUNCHES, TUBE BRUSHES, &C.

Monitor Binders FOR THE American Machinist,
$1 00 EACH BY MAIL OR EXPRESS.

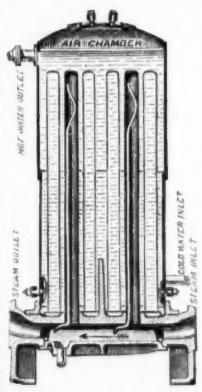
FRASSE & COMPANY,

62 Chatham Street, New York.

Fine Tools, Files, Steel Wire,
AND
SUPPLIES FOR MACHINISTS A SPECIALTY.

PATENT "ECONOMIC"

FEED WATER HEATER,



The Most Efficient,
Cheapest,
Easiest to Clean.

No Back Pressure,
Tubes Screwed in
And Free to Expand

No Grease in Boiler, Water Purified, and Pumped whilst cold. MOST DURABLE.

For Illustrated Circular, Particulars and Prices, apply to

Hampden Foundry & Machine Company,
BOSTON, MASS.

The Goulds Manufacturing Co.
Manufacturers of all kinds of

Force and Lift
PUMPS
For Cisterns, Wells, Railroads, Steamboats, Windmills, etc.
FIRE ENGINES, Hydraulic Rams, AMALGAM BELLS
For Churches, Schools and Plantations.
Corn-Shellers, Sinks, etc.
Pumps and Materials for Driven Wells a specialty.
Satisfaction guaranteed.
Catalogues furnished, upon application.

INQUIRE FOR GOULDS PUMPS
FACTORY, SENECA FALLS, N. Y.
WAREHOUSE, 15 PARK PLACE, NEW YORK CITY

IMPROVED

Anti-Incrustation Liquid,

For the Prevention and Removal of

SCALE IN STEAM BOILERS.

Is purely a liquid, free from sediment, contains no acid, and is absolutely safe and effective.

Prof. H G. Torrey, of the U. S. Assay Office, says: "Downer's Improved Boiler Liquid is free from all injurious substances, and well adapted to accomplish the object sought; know of nothing better and highly recommend it."

Circulars and references on application.

A. H. DOWNER,

PROPRIETOR AND SOLE MANUFACTURER,

17 Peck Slip, - New York.

New Mechanical Movement.

Patented March 9th, 1880.

A POSITIVE AND PERFECTLY NOISELESS SUBSTITUTE FOR PAWL AND RATCHET.

Edward Wright & Co.

561 Main Street,

WORCESTER,

MASS.

A. F. PRENTICE & CO.
Manufacturers of
Light Machinists' Tools.
FOOT POWER LATHES A SPECIALTY.
54 Hermon Street,
WORCESTER, Mass.

MACHINISTS'
AND
FOUNDRY SUPPLIES.

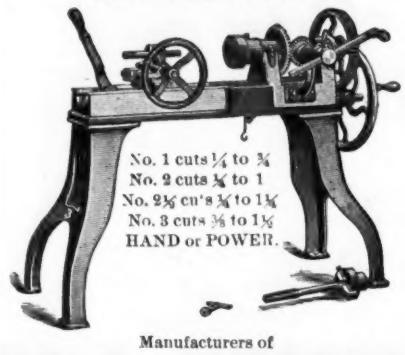
Machinists' Tools, Drills, and Taps and Dies. Also, **Belting and Steam Packing** of all kinds, and a general assortment of supplies for

FACTORIES AND MILLS.

T. B. BICKERTON & CO.
No. 12 South Fourth Street,
PHILADELPHIA, PA.

BOYNTON & PLUMMER,

WORCESTER, MASS.



Manufacturers of

BOLT CUTTERS,

Upright and Horizontal Drills,
For Blacksmiths' and Carriage Makers' Use.
Illustrated Catalogue furnished on application.

PATTERN AND BRAND LETTERS.
PRICES REDUCED.
VANDERBURGH, WELLS & CO.
Printers' and Engravers' Warehouse,
Corner Fulton and Dutch Sts.,
NEW YORK.

THE ONLY Exclusive Tool Store IN PHILADELPHIA.
HEADQUARTERS FOR TOOLS of all DESCRIPTION.

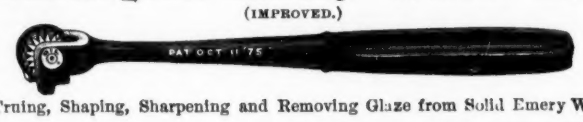
Taps & Dies, Morse Twist Drills, Calipers, Dividers, Stubs Tools, Stubs Files, Stubs Steel, Grobet Files, Carvers, Gravers, Chucks, Speed Indicators, Vises, Hammers, Machine, Set & Cap Screws, &c., &c.

L. B. EATON,
TOOL STORE
11 N. 6th St.
PHILA.

The Huntington Emery Wheel Dresser.

(IMPROVED.)

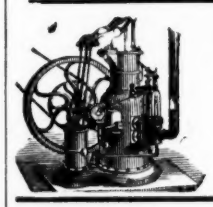
Invaluable to Users of Emery Wheels.



Thousands in Successful Use.

For Truing, Shaping, Sharpening and Removing Glaze from Solid Emery Wheels.

Price $4.00. Send for Circular. C. E. ROBERTS & CO., CHICAGO, ILL.

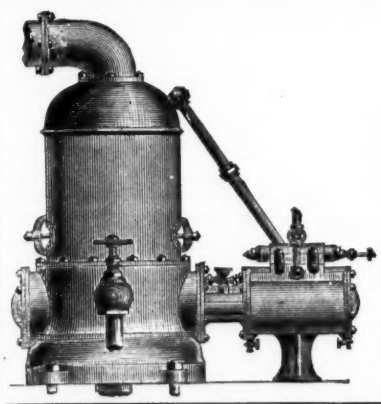


AIR ENGINES.

NO WATER.
NO ENGINEER.

No Extra Insurance! Absolutely Safe! Simple! Reliable! Durable!
Most Convenient and Economical Power Known.

SHERRILL ROPER AIR ENGINE CO.
Manufacturers of Air Engines, Elevators and Hoisting Machinery,
91 & 93 Washington St., New York.



20 Per Cent. Saving in Fuel,
25 Per Cent. Increased Power,

BY ATTACHING

HAMILTON'S INDEPENDENT AIR PUMP

AND CONDENSER

TO YOUR ENGINE.

Manufactured only by

SAWTELLE & JUDD,
HARTFORD, CONN.

ALMOND
DRILL
CHUCK

Made of Steel throughout, equal to doing any work required of it. Runs perfectly true.

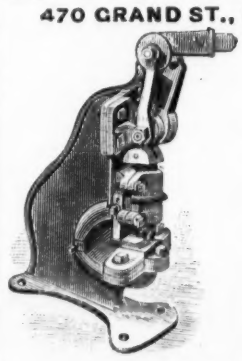
Have advanced price of Jewelers chuck to $5.

For sale by all Machinists' Supply Stores.

T. R. ALMOND
84 Pearl St.
BROOKLYN, N. Y.
(Cut shows Chuck full size.)

E. LYON & CO.

470 GRAND ST., NEW YORK.
Sole Manufacturers of



HYDRAULIC JACKS AND PUNCHES,
HYDRAULIC PRESSES,
HYDRAULIC PUMPS,
POLISHING AND BUFFING MACHINERY.

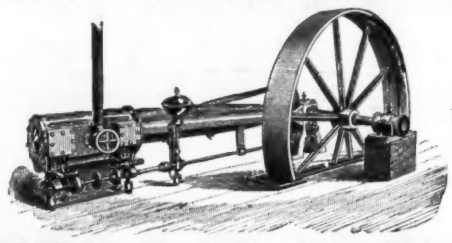
PRENTISS PATENT VISES,

ADJUSTABLE JAWS,
Stationary and Patent Swivel Bottoms,
Adapted to all kinds of Vise work.

HALL M'F'G CO., 23 DEY ST., NEW YORK.
SEND FOR CIRCULAR.

THE "BROWN" AUTOMATIC CUT-OFF ENGINE.

UNEXCELLED FOR **WORKMANSHIP, ECONOMY** AND **DURABILITY.**



WRITE FOR PRICES AND INFORMATION.

C. H. BROWN & CO., Sole Manufacturers,
FITCHBURG, MASS.

THE

LAWRENCE ENGINE,

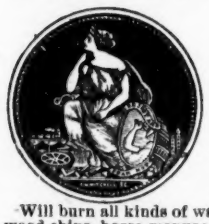
A FIRST-CLASS AUTOMATIC CUT-OFF STATIONARY

ENGINE.

Highest Economy. *Best Workmanship at a Moderate Price.*

ARMINGTON & SIMS, - LAWRENCE, Mass.

JARVIS PATENT FURNACE



FOR SETTING STEAM BOILERS.

Economy of Fuel, with increased capacity of Steam Power.

The same principle as the SIEMENS' PROCESS OF MAKING STEEL, utilizes the waste gases with hot air on top of the fire.

Will burn all kinds of waste fuel without a blast. including screenings, wet peat, wet hops, sawdust, log-wood chips, horse manure, &c.

A. F. UPTON, General Agent.

Also Agent for the Mahony Patent Corrugated Grates, with 50 per cent. air space. Send for Circular.

P. O. BOX 3401, BOSTON, MASS.

BARKER & BERTON,
NEW YORK AGENTS, - - - - - 422 East 23d Street.

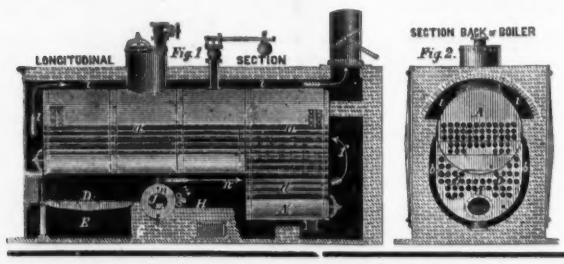
THE NASON MANUFACTURING CO.
DEALERS IN
Plain and Galvanized Wrought Iron Pipe,
AND MANUFACTURERS OF
STEAM AND GAS FITTINGS,
Steam Traps, Patent Vertical Tube Radiators, Steam and Hot Water Boilers, Steam Warming and Ventilating Apparatus, etc.
Nos. 71 Beekman and Fulton Streets, New York.

MONTGOMERY BOILER AND MACHINE WORKS.

WM. T. BATE & SON, East Conshohocken, PENNA.

MANUFACTURERS OF

Bate's Patent Steam Generator.



Iron Founders,
Boiler Makers AND
Machinists.

A large number of these boilers in use in the best establishments and institutions, showing **Splendid Results** in the way of economy, efficiency, durability and convenience of cleaning. We refer to parties using. Write for particulars.

THE

HANCOCK INSPIRATOR CO.

MANUFACTURERS OF

INSPIRATORS, EJECTORS,

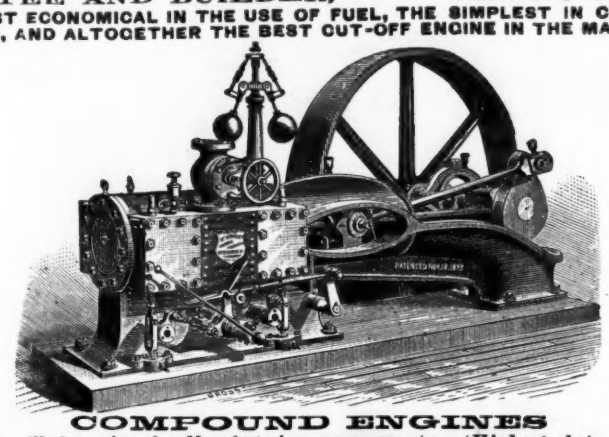
—AND—

GENERAL JET APPARATUS,

34 Beach Street, Boston, Mass.
35 Queen Victoria St., London, England.

Patent Automatic Cut-off Steam Engine.

WM. WRIGHT,
PATENTEE AND BUILDER, NEWBURGH, N. Y,
THE MOST ECONOMICAL IN THE USE OF FUEL, THE SIMPLEST IN CONSTRUCTION, AND ALTOGETHER THE BEST CUT-OFF ENGINE IN THE MARKET.



COMPOUND ENGINES
For City Water Works; also for Manufacturing purposes, etc. (*Highest duty guaranteed.*)
MARINE AND STATIONARY ENGINES.
STEAM BOILERS AND TANKS,
LIGHT AND HEAVY FORGINGS, SHAFTING, PULLEYS, HANGERS, MILL WORK, IRON AND BRASS CASTINGS,&c.
A LARGE GENERAL ASSORTMENT OF PATTERNS ON HAND.

PORTABLE AND STATIONARY
Engines and Boilers,

2½ to 15 H. P. Return Flue Boiler, large Fire Box, no sparks. Do not fail to send for circular to

SKINNER & WOOD, Erie, Pa.

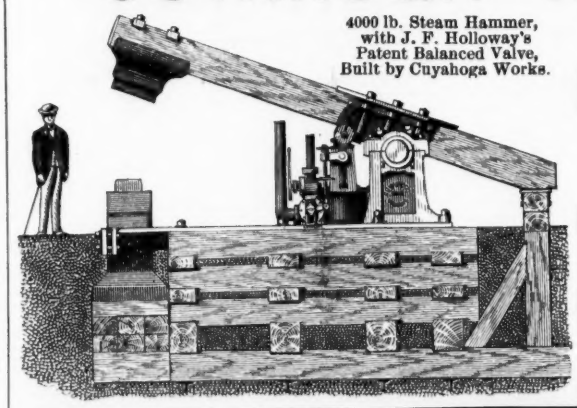
STEPHENS' PATENT PARALLEL VISE, with Swivel, Taper, Pipe and other attachments, is the handiest and most attractive in use, and is adapted to every variety of manufacture from Jewelers' to Locomotive Works. Twelve years constant use, ten hours each day, proves to us that a man cannot wear it out in a lifetime. Its parts are interchangeable. It opens **further,** holds **firmer,** is **heavier** and more **durable** than any other vise. Selected vises sent to any address by Express or C. O. D., with privilege of examining before taking. Write for illustrated circular. **Stephens' Patent Vise Co.,** 41 Dey Street, New York, U. S. A.

Over 1000 of these Turbines in operation in this and Foreign countries.

Tightshutting and easily operated gate. Large Pamphlet mailed free.

OFFICE YORK PENNA

CUYAHOGA WORKS



4000 lb. Steam Hammer, with J. F. Holloway's Patent Balanced Valve, Built by Cuyahoga Works.

Steam Hammers

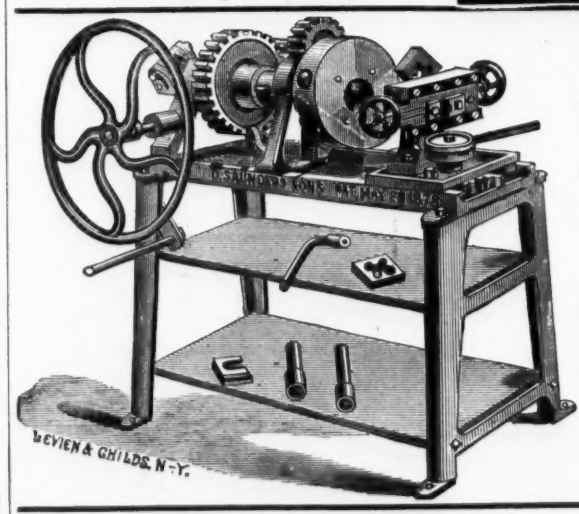
LAND
AND
MARINE ENGINES,
VERTICAL
Blowing Engines

For Blast Furnaces.

Cleveland, Ohio, U. S. A.

LATHE ATTACHMENTS
FOR MILLING
Plane and Irregular Forms.
Taps and Reamers Fluted and Gears cut without removing from the lathe centers.
See American Machinist, Sept. 13 and 20.
For circular address WM. MAIN,
65 Henry Street, Brooklyn, N. Y.

CHARLES MURRAY,
ENGRAVER ON WOOD.
No. 58 ANN ST.
NEW YORK.



D. SAUNDERS' SONS

New Pipe-Threading Machine

The I.X.L.

FOR HAND OR POWER.

Manufacturers of
Steam & Gas Fitters' Tools.

Pipe Cutting and Threading Machines for Pipe Mill Use, &c., a Specialty.

YONKERS, N. Y.

SEND FOR CIRCULARS.

H. L. STELLWAGEN, Mechanical Engineer, 254 N. 5th St., Philadelphia.

HORIZONTAL.
VERTICAL
Automatic Cut-off
ENGINES.
Yacht Engines,
Semi-Portable Engines.

STEEL AND IRON BOILERS.

All sizes to 225 horse-power.

Send for pamphlet and say where you saw this.

FITCHBURG STEAM ENGINE CO.
Fitchburg, Mass.

THE·STOW·FLEXIBLE·SHAFT·CO·LIMITED·

As this shaft transmits power through any number of curves, its value in the railroad and general machine shop, is at once apparent. We have designed, and keep in stock, a series of special tools for use with the shaft, as:—PORTABLE DRILLS for metals; AUGER CHUCKS for wood; CLAMPS for emery and buffing wheels, etc. CATALOGUE and PRICE LIST, on application.

500·NORTH·FIFTEENTH·ST·PHILADELPHIA·

W. H. HOFFMAN, M. E.,
PASSAIC, New Jersey.

Designer and Constructor of
Hawser and Rope Machinery
Working Drawings of Engines, Boilers, Machinists' and Boiler Makers' Tools.

Second-Hand & New Tools

APRIL LIST, NO. 2.

Miscellaneous Second - Hand Tools.

All in Good Order, and will be sold very Low.

1 Engine Lathe 96 in. swing x 18 ft. Bed.
1 Engine Lathe 50 in. " x 18 ft. "
1 Engine Lathe 50 in. " x 14 ft. "
1 Engine Lathe 17 in. " x 10 ft. "
7 Engine Lathes 18 in. " x 7½ ft. " (Chain Feed
1 Engine Lathe 24 in. " x 8 feet Bed.
1 Engine Lathe 20 in. " x 12 "
1 Engine Lathe 20 in. " x 6 "
1 Engine Lathe 20 in. " x 6 "
1 Horizontal Boring Lathe.
2 Wood Turning Lathes.
1 Bement Double Pulley Lathe.
1 Shafting Lathe 28 in. swing x 26 feet Bed.
1 Shafting Lathe 28 in. " x 25 "
1 Shafting Lathe 24 in. " x 26 "
1 Shafting Lathe 22 in. " x 22 "
1 Speed Lathe.
1 Polishing Lathe 20 in. " x 25 "
1 Polishing Lathe 25 in. " x 22 "
1 Pulley Lathe, Double Head.
2 Spinning Lathes, " "
1 Iron Planer 60 in. x 60 in. x 30 feet.
1 Iron Planer 32 in. x 30 in. x 10 "
1 Iron Planer 24 in. x 4 "
1 Upright Drill 60 in.
1 Upright Drill 48 in.
1 Upright Drill 38 in.
1 Upright Drill 38 in.
1 Upright Drill 16 in.
1 Upright Drill 16 in.
1 Drill, 4 Spindle.
1 Bench Drill.
1 Large Gear Cutter.
1 Small Gear Cutter.
1 Slabbing Machine.
1 Upright Boring Machine 78 in.
1 Pulley Polishing Machine.
1 Tool Grinder.
1 Pointing Screw Machine.
1 Daniels' Planing Machine.
Three Bolt Cutters, various sizes.
One No. 2 Bolt Cutter.
One New "Hardaway" Bolt Heading Machine, to head up to ⅞-in. bolts.
A lot of Wood Working Machinery.
Six Small Punching Presses.
One N. Y. Safety Steam Power Co., upright.
25 H. P. Engine, and 20 H. P. Upright Boiler with all connections, &c.

New Tools Very Low.

Five No. 2 Bolt Cutters, Wood & Light.
Two 26 in. swing back geared and self-feed Upright Drills.
One No. 1 Turret Lathe of American Tool & Machine Co.

Please specify which of the above tools you want, and we will forward all particulars.

STEAM LAUNCH,

40 ft. x 7 ft.; draws 3 ft., Engine 5¼ x 9; Boilers 32 x 48. Fitted with Carpets, &c., for pleasure.

A WOODRUFF & BEACH BEAM ENGINE,

Low pressure, 42-in. cylinder, 84-in. stroke, with fly-wheel pulley, 20 ft. diameter, 36-in. face, and

FOUR TUBULAR BOILERS,

60 inches in diameter, 20 ft. long, and all connections practically as good as new.

For Sale by

The George Place Machinery Agency,

121 Chambers and 103 Reade St.,

NEW YORK.

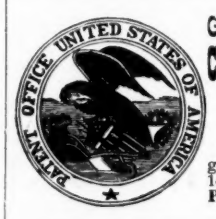
A PRACTICAL TREATISE ON
High Pressure Steam Boilers,

Including Results of Recent Experimental Tests of Boiler Materials, together with a description of approved Safety Apparatus, Steam Pumps, Injectors and Economizers in actual use.

By WILLIAM M. BARR.

1 Vol., octavo, 462 pages, 204 Engravings. Sent by mail or express, charges prepaid, to any address, upon receipt of **$4.00.**

JOHN BROTHERS, Publishers, Indianapolis, Ind.



GEO. C. TRACY & CO
Counselors at Patent Law
EUCLID AVE. BLOCK,
CLEVELAND, O.

Before doing anything in regard to Patents, send for our 140 page book, **"ALL ABOUT PATENTS,"** mailed free.

SECOND-HAND AND NEW
Machinists' Tools.

One Bement Six Spindle Drill, for Car Truck Frames.
One Engine Lathe, 90 in. x 20 ft. Ames. New.
One Engine Lathe, 30 in. x 20 ft. Good order.
One Engine Lathe, 30 in. x 16 ft.. Wheeler, new.
One " " 28 in. x 12 ft. Ames. New.
Three " " 20 in. x 10 ft. New. Lincoln.
One " " 18 in. x 10 ft. Harrington.
Two " " 20 in. x 8 ft. Pond.
One " " 18 in. x 8 ft. "
One " " 15 in. x 6 ft. Wheeler.
Six " " 16 in. x 7 ft. Ames, new.
Six " " 16 in. x 8 ft. " "
One Pulley Lathe, 20 in. x 6 ft.
One Hand Lathe, 18 in. x 4½ ft.
Two " " 20 in. x 8 ft.
Six " " 11 in. x 4½ ft. New Spencer.
Four " " 7 in. x 2½ ft. " "
One Planer, 20 in. x 4½ ft. Putnam.
One " 16 in. x 3 ft. Matteawan.
One Pratt & Whitney 2 Spindle Profiling Machine.
One Heavy Wood and Light Miller.
Two Lincoln Pattern Milling Machines.
One No. 3 Garvin Milling Machine.
One Combined Cutter and Reamer Grinder, with Threading Tool Grinder attached. New.
One Radial Drill, A1 order.
One 32 in. Drill, Bk Gear and Self-feed. Haines.
One 24 in. Drill, Self-feed. Ames. New.
One 22 in. Drill, Sliding Head. New.
One 20 in, " Prentiss, new.
One 18 in. " Fitchburg. Nearly new
One 17 in. " Blaisdell. Good as new.
One 10 in. " Blaisdell.
One Gear Cutter.
Three Sensitive Drills, drills to 3-16 in. hole.
One Boiler Makers' Combined Punch and Shear. New
One No. 3 Wilder Punch Press. Geared. New.
One No. 4 " " " Geared. New.
One No. 6 Wilder Shear. Geared, new.
One No. 1 Wilder Bar Iron Cutter. New.
One No. 3 " " " " "
One 10 H. P. Baxter Engine.
Seven Stephens' Vises.
Belting, Shafting and Miscellaneous Machinery.

We will also have ready to deliver in 60 days New Ames Mfg. Lathes as follows:

Two Engine Lathes, 20 in. x 8 ft.
Two " " 22 in. x 10 ft.
Five " " 24 in. x 12 ft.
Six " " 28 in. x 14 ft.

E. P. BULLARD,
14 Dey Street, New York.

Owing to an Overplus of Contracts,

FOR WHICH THEY HAVE TO THANK AN APPRECIATIVE PUBLIC,

THE BUCKEYE ENGINE CO.

BEG LEAVE TO

WITHDRAW THEIR ADVERTISEMENT.

RESPECTFULLY,

Buckeye Engine Co.

HILL, CLARKE & CO.,
36 Oliver Street, Boston,
NEW ENGLAND AGENTS.

Room 42, Coal & Iron Exchange,
NEW YORK

TO STEAM USERS.
Save Fuel and Money.

Obtain regular speed, and prevent explosion by using

PEERLESS DAMPER REGULATOR,

the greatest fuel-saving appliance ever invented. Adjustable to any pressure. In ordering mention pressure. Illus. catalogue sent on application. We set it up and guarantee performance. Price, $75.00.

AMERICAN STEAM APPLIANCE CO.
SOLE MANUFACTURERS,
13 and 15 Park Row - - NEW YORK.

RUFFNER & DUNN,
Schuylkill Falls, Philadelphia.

Sole manufacturers of the **Excelsior Steel Tube Cleaners.** Price, $1.00 per inch. Send for Circular containing names of users who consider it indispensable.

ENGRAVING ON WOOD
D. H. TUTTLE 5 BEEKMAN ST. N.Y.
Mechanical work a Specialty.

STEELINE.

Used for refining and tempering all kinds of Steel Tools.
Increases their durability at least five-fold.
Secures absolute safety from cracking.

Send for Circular to

BAUER & CO., 96 Greenwich Ave., N. Y.

LANE & BODLEY CO.
CINCINNATI, O.

Manufacturers of Wilson's Patent Free Open Double Disk

LEVER VALVE,

for Steam or Water, from 1¼" to 6". This valve has peculiar merits as a throttle valve for steam engines, and is well adapted to the use of a Sawyer's Valve, in place of the butterfly. Send for our catalogue and price list.

Headquarters for Machinists' Tools and Supplies.
CHAMPLIN & SPENCER,
154 East Lake Street, - Chicago, Ill.

Sole agents for the "Tanite" Emery Wheels and Grinding Machinery. Dealers in Screw Cutting Lathes from $50 to $150, with foot power, Small Amateur Lathes, Taps and Dies, "Twist Drills," Machine Screws, "Grobet Swiss Files," Machine Bits, Stubs' Steel Wire, Brown & Sharpe Tools, Emery, Crocus and Composition, Rouge, Drop Forged Lathe, Clamp and Die Dogs, Chucks, Wrenches, Hand and Bench Vises, Iron Levels, Metal Saws, Pattern Letters, Pliers, Calipers, Slide Rests, Steel Rules, Micrometer Calipers, Speed Indicators, "Metallic Corrugated Packing" for steam, air, gas or water joints, Steeline for hardening purposes, Upright and Hand Drills, Belting and Packing, Walrus Wheels, "Monk's Moulders' Tools," &c., &c

---

THE DIXWELL IMPROVEMENTS
For working Engines with
SUPERHEATED STEAM

Will reduce the consumption of fuel in non-condensing engines working under conditions otherwise favorable to economy, to 2.5 lbs. of coal per I. H. P. per hour, and in condensing engines to 1.75 lbs. of coal per I H. P. per hour.

Prevent the waste from Cylinder Condensation, which, tests show, amounts in every engine running to from 20 to 40%.

We will test, free of charge, engines now running, and show parties desiring to examine the Improvements how much they can save.

GEO. H. BARRUS, Agent,
553 Shawmut Ave., Boston.

Send for Circular and Pamphlets.

GEORGE P. CLARK,
Manufacturer of the Patent
RUBBER CASTOR.

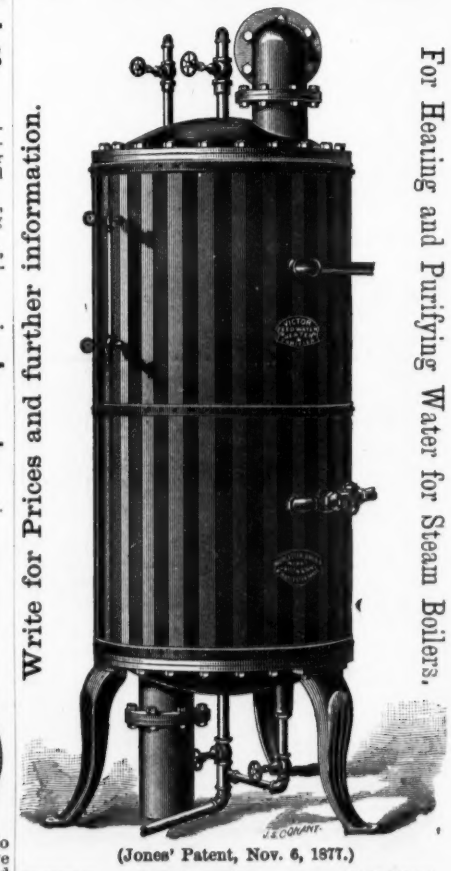
SECTIONAL VIEW.

The only Solid Socket Castor in the market. No more noise. No more marking of inlaid floors. Save your carpets by using the Rubber Castor. Warranted perfect in action. Also one of the best non-conductors for Rheumatism. Want to be used to be appreciated. Once tried always liked.

GEORGE P. CLARK, Windsor Locks, Ct.

THE FAR-FAMED
AMERICAN LUBRICATOR.
AMERICAN LUBRICATOR CO.
DETROIT, MICH. U.S.A.
SEND FOR PAMPHLET. TEN THOUSAND IN USE.

WORCESTER BOILER WORKS,
MANUFACTURERS OF THE
"VICTOR"
Feed-Water-Heater and Purifier.



For Heating and Purifying Water for Steam Boilers.

Write for Prices and further information.

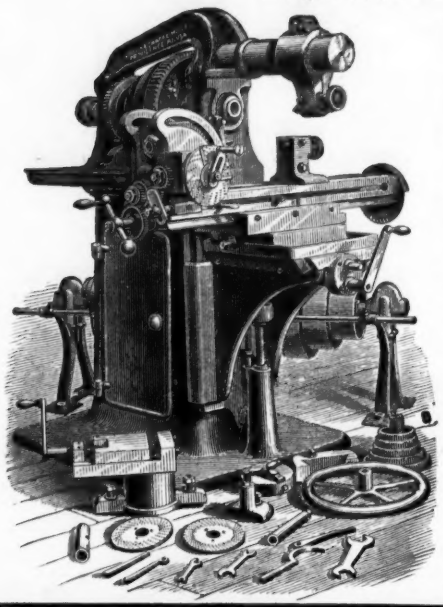
(Jones' Patent, Nov. 6, 1877.)

WM. ALLEN & SONS,
WORCESTER, MASS.

BROWN & SHARPE M'F'G CO.

PROVIDENCE, R. I.

MANUFACTURERS OF THE



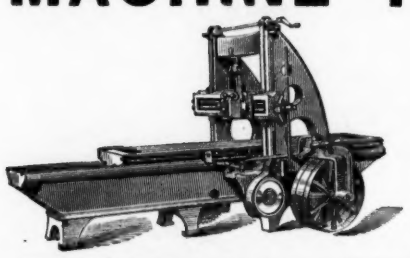
UNIVERSAL Milling Machine

This Machine has been designed especially to meet the wants of Steam Engine and Locomotive builders, and others engaged in the manufacture of heavy machinery and tools.

The essential features and motions are the same as in our smaller Universal Milling Machine, with such enlargement of the whole machine and its parts as would best adapt it for the class of work to be done. The cone has three diameters, each 3⅛ inches face. In addition, the cone is strongly geared, thus making six changes of speed. There are, also, the same number of changes of feed. The spindle boxes are of hardened cast steel, and, together with the spindle bearings, are carefully ground, and are provided with means of compensation for wear. The spindle will carry a cutter arbor projecting 15 inches, which is supported by an adjustable center at the outer end. Cutters of 8 inches or less diameter can be used. The horizontal movement of the spiral clamp bed upon the knee, in a line with the spindle of the machine, is 6½ inches, and the vertical movement of the spiral bed centers below the spindle centers is 11 inches. The spiral bed can be set at angles of 35° each way from center line of spindle, and can be fed automatically 22 inches, taking also 22 inches between the centers, and will swing 11½ inches.

☞ Illustrated Catalogue sent per mail on application.

MACHINE TOOL WORKS,



FORMERLY

FERRIS & MILES,

Twenty-fourth and Wood Streets

(Take Arch or Vine Street Car),

FRED'K B. MILES, Engineer. PHILADELPHIA

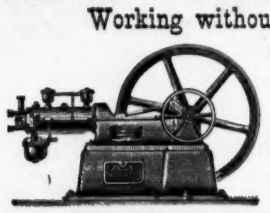
MACHINE TOOLS, STEAM HAMMERS, &c.

Having introduced many novel and valuable improvements into the construction of **SHAPING, SLOTTING, BORING** and **PLANING MACHINES**, as well as **Lathes** and **Drills**, we are now prepared to furnish these machines in greater perfection than ever before. By means of our improved devices the operations of turning, drilling, boring, planing and shaping, or slotting, can all be performed with a great saving of time and labor. It will be found worth any purchaser's while to examine our new methods of screw cutting, feed-gearing and convenient arrangements and attachments for enabling work to be done with the least possible expenditure. We would direct special attention to our new **4 FT. RADIAL DRILL**, with **6 Automatic Feeds, 10 IN. STROKE SHAPING MACHINES, 17 IN. SQUARE PLANING MACHINES** and **PATENT SCREW CUTTING LATHES**, which cut 16 threads and give 16 feeds **without changing gears.** Send for Catalogue.

FRED'K B. MILES.

NEW OTTO SILENT GAS ENGINE.

Working without Boiler, Steam, Coal, Ashes or Attendance.



STARTED INSTANTLY BY A MATCH, IT GIVES FULL POWER IMMEDIATELY.

WHEN STOPPED, ALL EXPENSE CEASES.

No Explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running. Recommended by Insurance Companies.

UNSURPASSED IN EVERY RESPECT for Hoisting in Warehouses, Printing, Ventilating, Running small Shops, etc.

2, 4 and 7 H. P. and upwards. Built by

SCHLEICHER, SCHUMM & CO., 3045 Chestnut St., Philadelphia.

Boston Agency, HILL, CLARKE & CO., 36 & 38 Oliver Street.

STEAM Pumping Machinery

For Feeding Steam Boilers, Filling Reservoirs and Tanks, and for General Pumping.

SEND FOR CATALOGUE

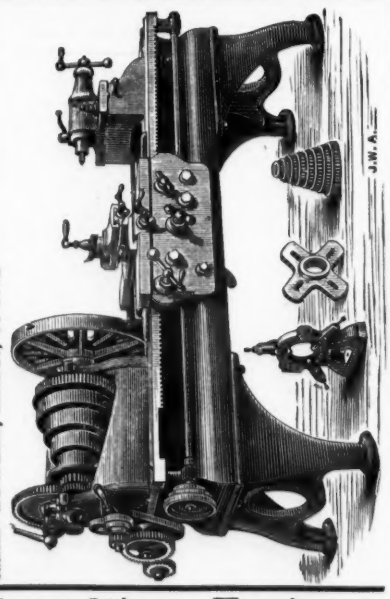
Illustrating every variety of

STEAM PUMPING MACHINERY.

Cope & Maxwell M'f'g Co.

HAMILTON, OHIO.

GEO. W. FIFIELD, Manufacturer of **ENGINE LATHES** from 16 to 46 in. swing. Cuts, Photographs and Prices furnished on application. **LOWELL, MASS., U. S. A.**



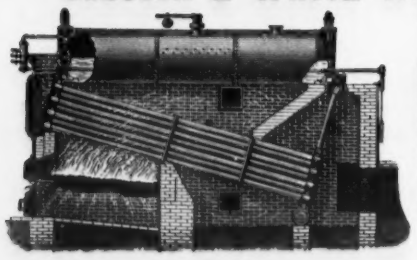
Machines at reduced prices, and Wheels *Guaranteed.*

LEHIGH VALLEY EMERY WHEEL CO.

Send for our new Illustrated Catalogue *Weissport, Penn.*

JAMES W. SEE, Consulting Engineer, *HAMILTON, OHIO.*

Babcock & Wilcox Water-Tube Steam Boiler,



Over 40,000 Horse-Power Now in Use. Adapted for all purposes. Safety from Explosions.

In sections easy of transportation. No bolted, screwed or packed joints. All joints made by expanding wrought iron tubes into bored holes. Can be erected or repaired by ordinary mechanic. Easily cleaned from soot or sediment. Adapted to all kinds of fuel. Steady water line and dry steam. No leaks from unequal expansion. Rapid steaming. Highest attainable economy. Centennial Exposition Medal awarded this boiler for highest economy and efficiency on test.

Illustrated Circulars and other desired information promptly furnished.

BABCOCK & WILCOX, Engineers, 30 Cortlandt St., New York.

THE PRATT & WHITNEY CO.

HARTFORD, CONN., U. S. A.

MAKE SPECIALTIES OF

Drop Hammers,

PUNCHING PRESSES,

HAND DRILLING MACHINES, RATCHET DRILLS, COMBINATION LATHE CHUCKS, CUTTERS FOR TEETH OF GEAR WHEELS, SCREW PLATES, HAND, MACHINE NUT AND PIPE TAPS, AND BOLT CUTTERS,

In connection with their business of

MACHINISTS' TOOLS, GUN, SEWING MACHINE and Special Machinery, &c.

PRICE LISTS FURNISHED ON APPLICATION.

THE BILLINGS & SPENCER CO.

HARTFORD, CT., U. S. A.

Manufacturers of the genuine

PACKER RATCHET DRILLS.

Drop Forged from best Norway Iron and Bar Steel.

PRICE LIST.

PACKER RATCHET.

No. 1.	10 inch	Handles		$10 50
" 2.	12 "	"		13.50
" 3.	15 "	"		16.00
" 4.	17 "	"		19.00
" 5.	20 "	"		23.00

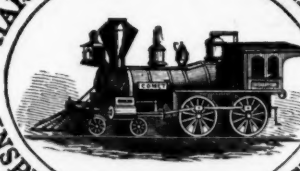
BOILER RATCHETS.

No. 1.	10 inch	Handles	$9.00
" 2.	12 "	"	10.50

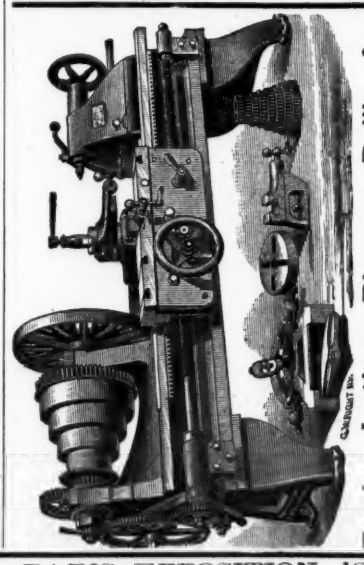
Steel and Iron Drop-forgings of every description for Guns, Pistols, Sewing Machines, Machinists' Tools and Machinery generally. Send for Illustrated Catalogue and Price List.

CUT GEARS of all sizes and kinds, Iron or Brass. Send for Circular. Gears cut to order. Models and light Machinery. Water Motors for driving Sewing Machines, etc. GEO. B. GRANT, 100 Beverly Street, Boston.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.



J. M. ALLEN, President.
W. B. FRANKLIN, Vice-President.
J. B. PIERCE, Secretary.



Engine Lathes, Planers, Drills, &c.

DAVID W. POND, Worcester, Mass.

Send for Catalogue of New Designs.

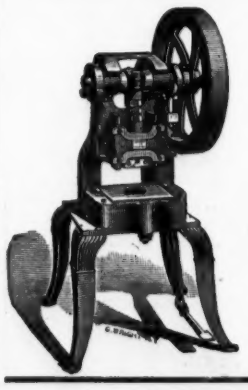
AIR COMPRESSORS.

PRICES REDUCED. SEND FOR NEW CATALOGUE.

CLAYTON STEAM PUMP WORKS.

14 AND 16 WATER STREET, BROOKLYN, N.Y.

GOLD MEDAL AWARDED, PARIS EXPOSITION, 1878.



BLISS & WILLIAMS,

Plymouth, Pearl and John Streets,

BROOKLYN, N. Y.

Manufacturers of all kinds of

Presses, Dies and Special Machinery

FOR WORKING SHEET METALS, &c.

FRUIT AND OTHER CAN TOOLS.

J. M. CARPENTER
PAWTUCKET, R.I.

Manufacturer of **TAPS AND DIES** of every description.

Also, for sale low, **UNITED STATES STANDARD GAUGES**, from ¼ to 3 inch.